



OFFERS

COMPLETE COVERAGE in electronic test instrumentation

Choose the exact electronic test equipment you need from the *-hp-* line — the world's most complete line of over 200 test instruments. Enjoy the engineering economies of fast, accurate measurements, sturdy dependability, broad application. Enjoy, too, the "family characteristics" of *-hp-* instruments—simple operation, minimum adjustment, independence of line voltage and tube changes, generous overload protection, trouble-free performance.

These pages give brief details of major *-hp-* instruments. For specific data or catalogs, write to factory on your letterhead or see your local *-hp-* representative.

hp Oscillators — Generators — .01 to 10,000,000 cps

-hp- 200 SERIES AUDIO OSCILLATORS



Six standard models. 200A, 200B have transformer-coupled output, deliver 1 watt into matched load. 200C, 200D and 202D (for sub-audio, audio, supersonic and carrier measurements) have resistance-coupled output, supply constant voltages over their entire frequency ranges. 200I, spread-scale oscillator for interpolation or where frequency must be known precisely.

-hp- 650A TEST OSCILLATOR



Highly stable, wide band (10 cps to 10mc) multi-purpose test oscillator for audio, supersonic, video and rf measurements. Output flat within 1 db. Range 0.00003 to 3 v. Output impedance 600 ohms or 6 ohms with voltage divider. \$475.00

Instrument	Primary Uses	Frequency Range	Output	Price
<i>-hp-</i> 200A	Audio tests	35 cps to 35 kc	1 watt/22.5v	\$120.00
<i>-hp-</i> 200B	Audio tests	20 cps to 20 kc	1 watt/22.5v	\$120.00
<i>-hp-</i> 200C	Audio and supersonic tests	20 cps to 200 kc	100 mw/10v	\$150.00
<i>hp-</i> 200D	Audio and supersonic tests	7 cps to 70 kc	100 mw/10v	\$175.00
<i>-hp-</i> 200H	Carrier current, telephone tests	60 cps to 600 kc	10 mw/1v	\$350.00
<i>-hp-</i> 200I	Interpolation and frequency measurements	6 cps to 6 kc	100 mw/10v	\$225.00
<i>-hp-</i> 201B	High quality audio tests	20 cps to 20 kc	3w/42.5v	\$250.00
<i>-hp-</i> 202A	Low frequency measurements	.01 cps to 1 kc	20 mw/10v	\$450.00
<i>-hp-</i> 202B	Low frequency measurements	½ cps to 50 kc	100 mw/10v	\$350.00
<i>-hp-</i> 202D	Low frequency measurements	2 cps to 70 kc	100 mw/10v	\$275.00
<i>-hp-</i> 204A	Portable, battery operated	2 cps to 20 kc	2.5 mw/5v	\$175.00
<i>-hp-</i> 205A	High power audio tests	20 cps to 20 kc	5 watts	\$390.00
<i>-hp-</i> 205AG	High power tests, gain measurements	20 cps to 20 kc	5 watts	\$425.00
<i>-hp-</i> 205AH	High power supersonic tests	1 kc to 100 kc	5 watts	\$550.00
<i>-hp-</i> 206A	High quality high accuracy audio tests	20 cps to 20 kc	+15 dbm	\$550.00
<i>-hp-</i> 650A	Wide range video tests	10 cps to 10 mc	15 mw/3v	\$475.00

hp Vacuum Tube Voltmeters— 2 to 700,000,000 cps

-hp- 410B VACUUM TUBE VOLTMETER



Wide range, flat response performance 20 cps to 700 mc. Convenient, simple to use, occupies minimum bench space. Handy compartment for detachable probe and leads. Diode probe design places approximately 1.3 μ fd capacity across circuit under test. This, plus high shunt impedance (10 megohms at low frequencies) means circuits under test are not disturbed, and true voltage readings are assured. 1 db accuracy, 20 cps to 700 mc. Also measures dc voltage to 1000 v and resistances to 500 megohms. \$245.00

Instrument	Primary Uses	Frequency Range	Voltage Range	Input Impedance	Price
<i>-hp-</i> 400A	General purpose ac measurements	10 cps to 1 mc	.005 to 300 v 9 ranges	1 megohm 24 μ fd shunt	\$185.00
<i>-hp-</i> 400B	Low frequency ac measurements	2 cps to 100 kc	.005 to 300 v 9 ranges	10 megohms 24 μ fd shunt	\$195.00
<i>-hp-</i> 400C	Wide range ac measurements High sensitivity	20 cps to 2 mc	.0001 to 300 v 12 ranges	10 megohms 15 μ fd shunt	\$200.00
<i>-hp-</i> 404A	Portable, battery operated	2 cps to 50 kc	.0005 to 300 v 11 ranges	10 megohms 20 μ fd shunt	\$185.00
<i>-hp-</i> 410B	Audio, rf, VHF measurements; dc voltages; resistances	20 cps to 700 mc	.1 to 300 v 7 ranges	10 megohms 1.3 μ fd shunt	\$245.00

-hp- Voltmeter Accessories (not listed) include voltage dividers, connectors, shunts and multipliers to extend useful range of your equipment.

Data Subject to Change Without Notice. Prices f.o.b. Factory.

HEWLETT-PACKARD

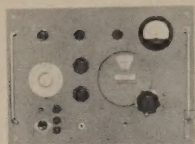


INSTRUMENTS



Signal Generators—10 to 7,600 mc

-hp- 618A SHF SIGNAL GENERATOR



3,800 to 7,600 mc. Provides a 1 mw signal into a 50-ohm coaxial load (zero dbm). Output attenuator directly calibrated in dbm and volts, reduces output level to less than -100 dbm. Frequency dial directly calibrated, accuracy $\frac{1}{2}$ of 1%. Repeller voltage automatically tracked. No adjustment during operation. CW, pulsed and FM output. \$2,250.00

Instrument	Frequency	Characteristics	Price
-hp- 608A	10 to 500 mc	Output 1 v to .1 μ v. Amplitude modulated, pulsed and CW output. Direct reading.	\$850.00
-hp- 610B	450 to 1,200 mc	Calibrated output, .1 v to .1 μ v. Internal pulse modulation. Direct calibration	\$925.00
-hp- 614A	800 to 2,100 mc	Direct reading. Pulse modulation, CW & FM. Output 1 mw or .223 v to .1 μ v	\$1,950.00
-hp- 616A	1,800 to 4,000 mc	Direct reading. Pulse modulation, CW & FM. Output 1 mw or .223 v to .1 μ v	\$1,950.00
-hp- 618A	3,800 to 7,600 mc	Direct reading. External pulse modulation, C W & FM. Output .223 v to 2.23 μ v	\$2,250.00



Distortion, Wave Form Analyzers—20 cps to 20 kc

-hp- 330B DISTORTION ANALYZER



Measures distortions as low as 0.1% at any frequency, 20 cps to 20 kc. Measures noise voltages as low as 100 μ v. High sensitivity, high stability, broad applicability for broadcast, laboratory or production problems. Wide band 20 db gain input amplifier. Built-in vacuum tube voltmeter usable separately. \$395.00

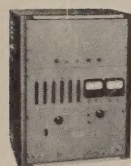
FM, AM-FM MODELS

-hp- 330C, for FM broadcasters, includes VU meter meeting F. C. C. requirements. -hp- 330D, for AM-FM broadcasters, includes AM detector to rectify AM carrier, plus VU meter employed in model 330C. 330C, \$425.00. 330D, \$440.00

Analyzer	Primary Uses	Frequency Range	Characteristics	Price
-hp- 300A	Wave form analyzer	30 cps to 16 kc	Variable selectivity; measuring range 1 mv to 500 v.	\$625.00
-hp- 320A	Measures total distortion	400 cps and 5 kc	Requires external detector	\$ 75.00
-hp- 320B	Measures total distortion	50, 100, 400 cps, 1, 5 and 7.5 kc	Same as above	\$150.00
-hp- 330B	Measures total distortion	20 cps to 20 kc	Includes input amplifier, VTVM	\$395.00
-hp- 330C	For FM measurements	20 cps to 20 kc	Special VU meter to meet F. C. C. requirements	\$425.00
-hp- 330D	For AM, FM measurements	20 cps to 20 kc	AM detector and VU meter to meet F. C. C. requirements	\$440.00
SQUARE WAVE GENERATOR				
-hp- 210A	Transient and frequency response	20 cps to 10 kc	Output 50 v. peak-to-peak. 1,000 ohm impedance	\$150.00



Frequency Measuring Equipment—.01 cps to 10 mc



-hp- 524A FREQUENCY COUNTER

Instantly, automatically, directly measures unknown frequencies, .01 cps to 10 mc!

One instrument combines functions of frequency standard, interpolating system and detector! Amazingly simple operation—just connect unknown to input terminal, and exact frequency appears automatically on front panel. High speed decade scalars count unknown frequency over measured, crystal-controlled time interval. Accuracy of measurement ± 1 count \pm crystal stability (2/1,000,000 per week). External higher accuracy standard usable if desired. Minimum of unknown, 1 v peak. \$2,000.00

-hp- 100D SECONDARY FREQUENCY STANDARD



Swift, sure frequency comparison, new convenience in standardizing with minimum external equipment. 100 μ sec time markers, built-in oscilloscope, sine or rectangular waves. Low output impedance, short-time stability 1/1,000,000. Performs most functions of expensive primary standards in audio, rf or supersonic ranges. \$600.00

Instrument	Primary Uses	Frequency Range	Characteristics	Price
-hp- 524 Frequency Counter	Frequency, interval, time measurements	.01 cps to 10 mc	Direct reading, no interpolation, accuracy about 2/1,000,000	\$2,000.00
-hp- 100D Secondary Standard	Frequency, time measurements	100 kc, 10 kc, 1 kc, 100 cps, 10 cps	Stability 1/1,000,000 (short-time). Sine or rectangular output. Marker pips.	\$ 600.00
-hp- 100C Secondary Standard	Audio, supersonic calibration	100 kc, 10 kc, 1 kc, 100 cps	Accurate within $\pm .001\%$. Sine waves only.	\$ 450.00
-hp- 500A Frequency Meter	Rapid frequency measurements	5 cps to 50 kc	10 ranges $\pm 2\%$ accuracy. Input 0.5 to 200 volts.	\$ 210.00
-hp- 505A Tachometer	Measurements of high speed machinery	300 to 3,000,000 rpm	10 ranges $\pm 2\%$ accuracy.	\$ 300.00
-hp- 505B Tachometer	Same as above	5 to 50,000 rps	Same as 505A except calibrated in rps.	\$ 300.00

Frequency monitors available for FM broadcast, 88 to 108 mc, TV aural broadcast 59.75 to 215.75 mc; and for communications systems, 30 to 175 mc.

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Complete Coverage! HEWLETT-PACKARD

Microwave Test Equipment—10 to 18,000 mc!

Basic, low cost elements offer utmost flexibility for assembly of exact instrumentation required. Each unit covers entire range of its waveguide size. Simple, sturdy mechanical design; accurate, multi-purpose operation.

Instrument	Coaxial Type N. Conn.	"S" 3" x 1 1/2" 2.6 - 3.95 kmc.	"G" 2" x 1" 3.95 - 5.85 kmc.	"J" 1 1/2" x 3/4" 5.85 - 8.2 kmc.	"H" 1 1/4" x 3/8" 7.05 - 10.0 kmc.	"X" 1" x 1/2" 8.2 - 12.4 kmc.	"P" .702" x .391" 12.4 - 18.0 kmc.
Adaptors, Waveguide to Coax		S281A \$75.00	G281A \$55.00	J281A \$50.00	H281A \$45.00	X281A \$35.00	
Cover to choke flange		S290A \$40.00	G290A \$30.00	J290A \$25.00	H290A \$20.00	X290A \$15.00	P290A \$20.00
Attenuators, Fixed 6, 10, 20 db		S370 \$75.00	G370 \$65.00	J370 \$65.00	H370 \$60.00	X370 \$55.00	P370 \$60.00
Flap, 25 db max.		S375A \$75.00	G375A \$65.00	J375A \$60.00	H375A \$55.00	X375A \$50.00	P375A \$55.00
Calibrated		S380A \$225.00					
Detector Mounts	440A† \$85.00	S485A* \$125.00	G-485B† \$95.00	J485B† \$90.00	H485B† \$85.00	X485B† \$75.00	
Frequency Meters, Reaction				J530A \$120.00	H530A \$120.00	X530A \$120.00	
Slotted Sections	806B§ \$200.00	S810A* \$450.00	G810B§ \$90.00	J810B§ \$90.00	H810B§ \$90.00	X810B§ \$90.00	
Waveguide Tees, Series		S840A \$60.00	G840A \$50.00	J840A \$40.00	H840A \$35.00	X840A \$30.00	P840A \$35.00
Shunt		S841A \$60.00	G841A \$50.00	J841A \$40.00	H841A \$35.00	X841A \$30.00	P841A \$35.00
Hybrid		S845A \$90.00	G845A \$75.00	J845A \$60.00	H845A \$55.00	X845A \$45.00	P845A \$55.00
Transformers, Slide-screw		S870A \$150.00	G870A \$140.00	J870A \$135.00	H870A \$130.00	X870A \$125.00	P870A \$130.00
E-H		S880A \$175.00	G880A \$155.00	J880A \$145.00	H880A \$135.00	X880A \$130.00	P880A \$135.00
Adjustable Shorts		S920A \$80.00	G920A \$70.00	J920A \$65.00	H920A \$60.00	X920A \$50.00	P920A \$55.00
Terminations, Low Power		S910A \$45.00	G910A \$40.00	J910A \$35.00	H910A \$30.00	X910A \$25.00	P910A \$30.00
Terminations, High Power		S912A \$125.00				X912A \$75.00	
Broad Band Probe	442A \$75.00	All Frequencies					
Broad Band Probe, Untuned	444A \$50.00	All Frequencies					

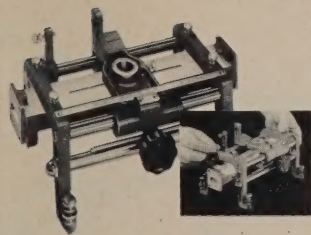
*For use with bolometer only.

†For use with bolometer or crystal.

*Complete assembly including carriage.

§Mounts in 809B carriage

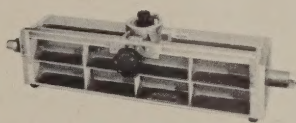
-hp- 809B UNIVERSAL PROBE CARRIAGE



Broad Band Probe and -hp- 440A Coaxial Detector in combination; or with -hp- 444A Untuned Probe. -hp- 809B, \$160.00

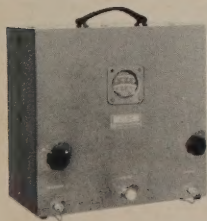
Now—a single all-purpose probe carriage operates with 5 different -hp- slotted sections—waveguide and coaxial. Mounts sections covering frequencies 3,000 to 12,400 mc—sections can be interchanged in 30 seconds! Carriage calibrated in mm. to 0.1 mm.; dial gauge may be mounted for more accurate readings. Operates with -hp- 442A

-hp- COAXIAL SLOTTED SECTIONS

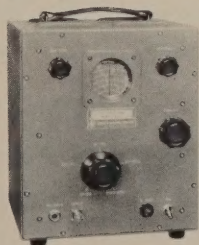


-hp- 805A/B. 500 to 4,000 mc. High accuracy, high stability, negligible slope, minimum leakage. Exclusive parallel plane design with non-bowing central conductor. VSWR of basic section and connectors less than 1.04. -hp- 805A, 50 ohms, Type N connector, for flexible cables. -hp- 805B, 46.3 ohms, for 7/8" rigid transmission lines. \$475.00

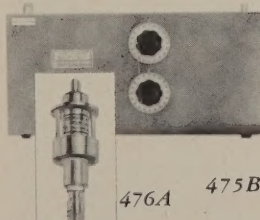
-hp- 806B. 3,000 to 12,000 mc. Same parallel plane design as 805A/B. For use with 809B Carriage. VSWR of section and connectors 1.06 to 10,000 mc. 50 ohm impedance, negligible slope. Type N connectors for flexible cable. \$200.00



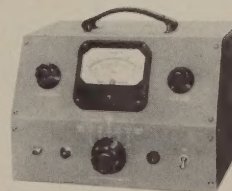
-hp- 803A VHF Bridge reads impedance magnitude and phase direct, 10 to 500 mc. Rapid operation, for comparative measurements 5 to 1,000 mc. Impedance range 2 to 2,000 ohms. Phase angle -90° to +90° at 52 mc and above. \$495.00



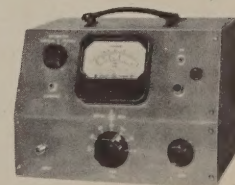
-hp- 417A VHF Detector, for use with 803A Bridge; or general laboratory readings. Super-regenerative receiver, 10 to 500 mc, 5 bands. Approx. 5 μv sensitivity over entire band. Direct reading frequency control, thoroughly shielded. \$200.00



New -hp- 476A Universal Bolometer Mount measures rf power 10 to 1,000 mc. No tuning or adjustment. VSWR less than 1.15, 20 to 500 mc; 1.25, 10 to 1,000 mc. \$125.00. -hp- 475B Tunable Mount, continuous 1,000 to 4,000 mc. \$200.



-hp- 430A Microwave Power Meter provides instantaneous rf power readings direct in db or mw at all bolometer mount frequencies. No calculations, no adjustment except zero set. For -hp- bolometer mounts: 475B, 476A, 485. \$250.00



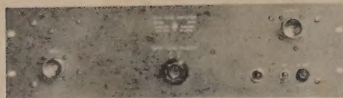
-hp- 415A Standing Wave Indicator for all waveguide or coaxial slotted sections. Gives direct readings in VSWR or db. Single frequency operation; 300 to 2,000 cps. Low noise level, 0.3 μv sensitivity, 60 db calib. attenuator. \$200.00

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INSTRUMENTS Complete Coverage!

-hp- AMPLIFIERS



2-inch deflection of 5CP tubes. Rise time 0.0026 μ sec; can amplify milli-microsecond pulses; gives over 100 mc bandwidth to your standard oscilloscope. 460A, \$185.00; 460B, \$225.00. Connecting cables, plugs, accessories—prices on request.

-hp- 450A Amplifier—general purpose instrument, 20 db or 40 db gain, for use wherever wide frequency range and high stability are needed. 10 cps to 1 mc. Negligible phase shift, no spurious responses. \$140.00

Complete instrumentation for distortion-free, fast pulse measurement. **-hp- 460A Wide Band Amplifiers**, in cascade with **-hp- 460B Fast-Pulse Amplifiers** offer up to 90 db gain, 125 volts open circuit output. This permits full deflection of 5XP CRT, or

-hp- 520A NUCLEAR SCALER



0.2 μ sec. Two-decade circuit gives scaling factor of 100; residual counts are indicated by two panel meters with combined capacity of 100 counts. Instrument may be used with existing low speed scalers to provide any desired count capacity. \$600.00

-hp- 520A is a new, high-speed 10 mc scaler offering utmost reliability in nuclear counting and frequency measurements. Capable of scaling pulses at rates up to 10,000,000 pps. Has double-pulse resolving time of 0.1 μ sec; triple-pulse resolving time of

-hp- POWER SUPPLIES

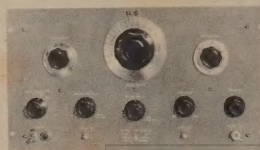


-hp- 715A (illustrated) is a versatile source of regulated beam and reflector voltage for operating most test bench klystron tubes. Beam voltage 250 to 400 v; reflector voltage 10 to 900 v; 6.3 v filament. Internal, 1,000 cps square wave modulation, also 60 cps FM modulation, both on reflector voltage. \$300.00

-hp- 710A—Highly stable regulated dc supply, output variable 180 to 360 v at 75 ma., 6.3 v filament. Either terminal may be grounded. Total hum and noise less than 5 mv. \$85.00

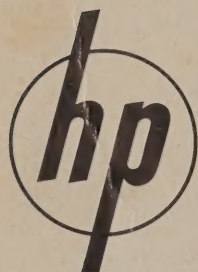
-hp- 712A. Stabilized, variable power supply providing 0 to 500 v at 200 ma and 1/2% regulation. Also variable bias voltages, 0 to 150 v at 5 ma, and 6.3 v filament at 10 amps. Main supply completely metered. Either terminal may be grounded. Hum less than 8 mv. For laboratory, production or general use. \$350.00

-hp- 212A PULSE GENERATOR



Provides continuously variable, high power "fast pulses" of superior wave form. Combines broad general usefulness with 0.02 μ sec rise and decay time to meet requirements of radar, TV and nuclear work. Pulse length variable 0.07 to 10 μ sec; minimum overshoot; 50 watt peak power (50 v to 50 ohms loads). Low impedance means accurate pulses can be delivered at a distance from the instrument. Repetition rate variable 50 to 5,000 pps; controlled internally or externally. Synchronizing pulses available in advance of, or following, output pulse. \$550.00

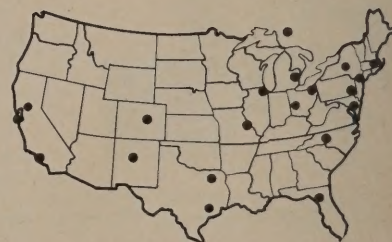
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-hp- has selected the best independent organizations in America to give you personal help with measuring problems. Electronics specialists—men trained by Hewlett-Packard—save you time by helping select exact **-hp-** instrumentation you need. These men are located in major business centers—as near as your telephone. Call them when you need personal help—in your plant—today!



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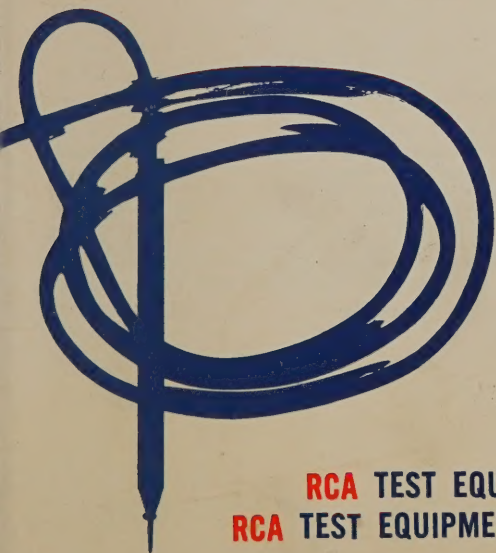
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INSTRUMENTS



ELECTRONIC INSTRUMENTS



RCA TEST EQUIPMENT
RCA TEST EQUIPMENT KITS

BATTERY TESTER

WV-37B



The WV-37B is designed to test over 60 different types of tube-portable and transistor-portable radio batteries. The tester has a large easy-to-read meter which tests batteries in terms of "REPLACE-USABLE-GOOD" and above these colored ranges a scale shows the percentage of rated output voltage of the battery under test. Simple, and easy-to-use, the new WV-37B Battery Tester also has eight blank switch positions which allow for testing future additional battery types.

\$24.95* (Price includes permanently-attached test probes and leads, instruction bulletin)

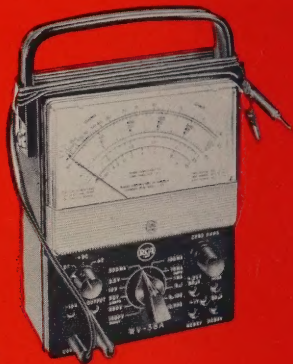
*User Price (Optional)

VOLT-OHM-MILLIAMMETER

**WV-38A(K)
KIT**

WV-38A

**FACTORY-WIRED
AND CALIBRATED**



Never so many valuable features packed into a VOM! Exclusive with the new RCA WV-38A VOM and WV-38A(K) VOM Kit are the special ranges for transistor servicing — extra 0.25-volt and 1-volt ranges — and new spring clips on handle to accommodate probes and test leads for extra carrying convenience. The new WV-38A(K) VOM Kit is extremely easy to assemble! Just mount six components on the front panel, wire all other components on one side of the laminated circuit board, attach circuit board to panel, and put on knobs and back cover! The WV-38A and WV-38A(K) have these popular features: ohms-divider network fuse-protected; easier-to-read scales; polarity reversal switch; improved frequency response; full-wave bridge rectifier; standard dbm ranges; plus modern styling! W 5 $\frac{1}{4}$ " x H 6 $\frac{7}{8}$ " x D 3 $\frac{1}{8}$ ".

Prices for the WV-38A(K) and WV-38A include internal batteries, probe and cable with slip-on alligator clip, and instruction booklet. Assembly instructions are provided with the WV-38A(K) VOM Kit.

WG-270 Carrying Case for WV-38A Volt-Ohm-Milliammeter. Features: rugged, scuff-proof, stain-resistant, laminated vinyl construction—looks and wears like leather; snap-off front cover for instant use; storage compartment below instruments for probes and leads; attractive gray finish — modern, functional styling! \$4.95*

\$29.95* WV-38A(K)
Kit of parts to assemble WV-38A

\$43.95* WV-38A
(Factory-wired and calibrated)

*User Price (Optional)

VOLTOHMYST[®]



WV-77E(K) KIT

WV-77E FACTORY-WIRED AND CALIBRATED

NOW — at popular prices — here is a new addition to the world-famed RCA VoltOhmyst family! Kit or wired, no “do-it-yourself” markings appear on the front panel! The WV-77E(K) is extremely easy to assemble! The laminated circuit board is keyed for accurate placement of components — the range switch has only two decks — the single-sheet instructions are the ultimate in clarity! The WV-77E features flat frequency response $\pm 5\%$ from 40 CPS to 5 Mc on the 1.5, 5, and 15-volt rms ranges and the 4, 14, and 40-volt peak-to-peak ranges. The WV-77E measures dc from 0.02 volt to 1500 volts, rms ac from 0.1 volt to 1500 volts, peak-to-peak ac from 0.2 volt to 4000 volts, and resistance from 0.2 ohm to 1000 megohms — all in seven overlapping ranges. Full scale accuracy is $\pm 3\%$ on dc and $\pm 5\%$ on ac. Meter is electronically protected against burn-out. Separate scales are provided for low ac measurements. Input resistance is standard 11 megohms. Width 5 $\frac{5}{8}$ ", Height 7 $\frac{3}{4}$ ", Depth 4 $\frac{3}{4}$ "; Weight 5 lbs.

- NEW — sleeve on handle stores probes and cables
- NEW — fuse in ohms circuit prevents accidental burnout
- NEW — circuit minimizes effect of residual gas in bridge tube
- NEW — color-coded scales for easier, faster readings
- NEW — ultra-slim probes and extra-flexible cables

Prices for WV-77E(K) and WV-77E include dc probe and cable, ac/ohms probe and cable, ground lead and clip, and instruction booklet — PLUS — FREE booklet “Servicing Is Easy with the RCA VoltOhmyst” (\$1.00 value). Assembly instruction sheet is provided with the WV-77E(K) VoltOhmyst Kit.

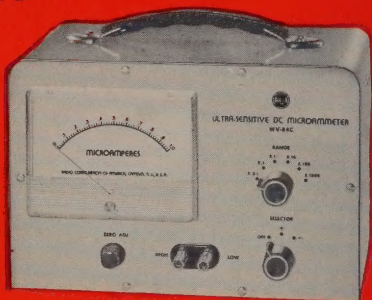
\$29.95* WV-77E(K)
Kit of parts to assemble WV77E

\$43.95* WV-77E
(Factory-Wired)

*User Price (Optional)

ULTRA-SENSITIVE DC MICROAMMETER

WV-84C



A valuable instrument which is finding increased use in industrial, chemical, and general laboratory applications, the WV-84C is a battery-operated vacuum-tube microammeter designed for measuring minute direct currents. Self-contained batteries permit use almost anywhere. Low-drain tubes extend battery life and protect the meter against burnout due to accidental overloads. When the WV-84C is used as a voltmeter, it is especially suited to measurements in circuits where loading is a critical factor. Can also be used as an ohmmeter to measure extremely high resistances such as leakage and insulation resistance.

- Six direct-current ranges for measuring currents from 0.0002 to 1000 microamperes.
- Can be used as ohmmeter to measure resistance in the order of billions of ohms.
- Input resistance of 100 megohms for measurement of voltages from 0.1 to 1 volt; 1000 megohms input resistance for voltages to 10 volts, 1005 megohms for voltages to 100 volts.
- Over-all microammeter accuracy on X.01 range $\pm 5\%$ of full scale; accuracy on all other ranges $\pm 4\%$ of full scale.
- Voltage drop for full-scale deflection only 0.5 volt.

\$110.00* Includes 50- and 950-megohm multiplier resistors, instruction booklet (less batteries).

*User Price (Optional)

MASTER VOLT OHMYST

WV-87B



Featuring a $7\frac{1}{2}$ " meter, the Master Volt Ohmyst is the deluxe member of the RCA Volt Ohmyst family. Its peak-to-peak scales are particularly useful for TV, radar, and other types of pulse work. The WV-87B has the accuracy and stability necessary for many laboratory applications. Its large, easy-to-read meter also makes it especially desirable as a permanently mounted instrument in the factory and repair shop. Width $13\frac{1}{2}$ ", Height 10", Depth 7".

- Measures dc voltages accurately in high-impedance circuits, even with ac present. Reads rms values of sine waves and peak-to-peak values of complex waves or recurrent pulses, even with dc present.
- Measures resistance from 0.2 ohm to 1000 megohms, current from 10 microamperes to 15 amperes.
- Frequency response flat to 30 cps—important in hi-fi and vertical deflection circuit measurements.
- Features $\pm 1\%$ multiplier and shunt resistors, a $\pm 2\%$ meter movement.
- Zero-center scale adjustment for discriminator alignment.
- DC polarity reversing switch.

\$137.50*

complete with probes and cables, including:
WG-299D DC/AC-OHMS Probe & Cable, Positive
Current Lead, Negative Current Lead, Ground Lead, Instruction
booklet.

*User Price (Optional)

SENIOR VOLTOHMYST

WV-98A



The new Senior VoltOhmyst, WV-98A, includes an improved circuit providing 3% accuracy full scale on both ac and dc measurements with better than 1% tracking error. Separate color-coded peak-to-peak and rms-voltage scales in two distinctive colors simplify readings. Permits direct reading of peak-to-peak voltages of complex waveforms, found in video, sync, and deflection circuits. Features die-cast aluminum case; high input resistance; meter electronically protected against burnout; rugged 200-microampere meter movement; and precision multiplier resistors with accuracy of $\pm 1\%$. Width 7", Height $6\frac{1}{2}$ ", Depth $3\frac{3}{4}$ ".

- Large easy-to-read, full-vision meter (26 sq. in.).
- Measures complex wave forms directly from 0.2 volt to 4200 volts peak-to-peak.
- Measures rms values of sine waves from 0.1 volt to 1500 volts.
- Frequency response flat to 30 cps—important in hi-fi and TV vertical deflection circuit measurements.
- Measures from 0.02 volt dc to 1500 volts on two scales, in seven overlapping "3-to-1" ranges.
- Measures resistance from 0.2 ohm to 1000 megohms on single scale, with seven overlapping ranges.

\$79.50* complete with WG-299D DC/AC-Ohms Probe and Cable, Ground Cable, Alligator Clip, Clip Insulator, instruction booklet.

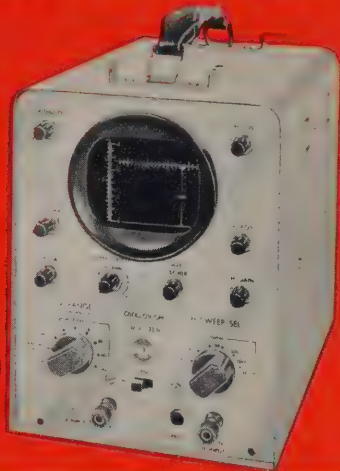
*User Price (Optional)

SUPER-PORTABLE OSCILLOSCOPE

WO-33A(K) KIT

WO-33A

FACTORY-WIRED AND CALIBRATED



The new WO-33A Oscilloscope is the scope you can take with you on the job! It's an ideal *second scope* because it's SUPER-PORTABLE — only 14 pounds — and its small, compact size, plus its high gain and wide bandwidth, will let you tackle virtually any electronics servicing job you encounter inside or outside the shop! The WO-33A will give you what you need in gain, bandwidth, transient response, accuracy, versatility, and portability. And it's also available as a WO-33A(K) Kit. The kit features module-type sectional construction — front panel, back panel, laminated circuit board, and CRT — for extreme ease of assembly. The WO-33A features voltage calibrated frequency-compensated 3-to-1 step attenuator; scaled graph screen and calibrating voltage source allows direct reading of peak-to-peak voltages; "plus-minus" internal sync — holds sync to 4.5 Mc; shielded input cable with low-capacitance probe; built-in brackets to hold power cord, cables and probe. W 6½" x H 8¾" x D 10¼".

Prices for the WO-33A(K) and WO-33A include WG-349A Low-Cap/Direct Input Probe and Cable, alligator clip and insulator, ground lead, green graph screen, and instruction booklet. Assembly instructions are provided with the WO-33A(K) Oscilloscope Kit.

\$79.95* WO-33A(K)
Kit of parts to assemble WO-33A

\$129.95* WO-33A
(Factory-wired and calibrated)

*User Price (Optional)

5" OSCILLOSCOPE

WO-91A



The WO-91A is designed for production and servicing both black-and-white and color-TV receivers. It can be used to measure color burst signals and for trouble-shooting wide-band color circuits. A multi-scale graph screen makes peak-to-peak voltage measurements as simple as with a VTVM. Panel switch for wide-band or high-sensitivity operation. Response: wide-band operation within ± 1 db 10 cps to 4.5 Mc; High-sensitivity operation within -1 db 10 cps to 0.05 Mc; within -6 db 1.5 Mc. Sensitivity: 0.05 volt peak-to-peak per inch (0.018 volt rms) in high-sensitivity position; 0.15 volt peak-to-peak per inch (0.053 volt rms in wide-band position). Width 9", Height $13\frac{1}{2}$ ", Depth $16\frac{1}{2}$ ".

- Voltage-calibrated, frequency-compensated, 3-to-1 step attenuator for "V" amplifier.
- Shielded vertical-input connector and shielded cable minimize hum, stray field pick-up.
- Z-Axis input terminals.
- Preset "V" and "H" sweep positions.
- "Plus" or "minus" internal-sync selector.
- Positive-lock internal sync.

\$239.50* complete with WG-300B two-way Direct/Low-Capacitance Probe and Cable, alligator clip and insulator, ground cable, green graph screen, instruction booklet.

*User Price (Optional)

VIDEO-DOT / CROSSHATCH GENERATOR

WR-46A



The WR-46A is designed for making static and dynamic convergence adjustments in color-TV sets. The WR-46A produces highly stable dot, bar, or crosshatch patterns and will drive a picture tube directly. Equalizer control provided for V and H bar brightness. Solid pattern — exceptionally free of crawl and jitter. Pattern independent of receiver rf/lf response. Output cables are dc isolated. Width 13½", Height 10", Depth 8".

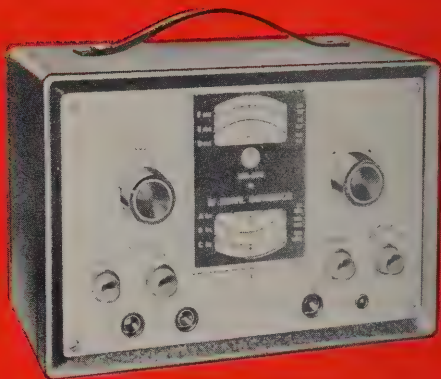
- Video output of 45 v across 4000 ohms.
- Vertical bars continuously adjustable from 10 to 25 (approx.) bars.
- Cable connections on back of cabinet.
- Reversible video output polarity.
- Simple connections to TV receiver.

\$179.50* complete with Sync-Pickup lead, Ground lead, Output Cable and instruction booklet.

*User Price (Optional)

RF SIGNAL GENERATOR

WR-49B



The lightweight WR-49B is ideal for such applications as alignment and signal tracing of AM and FM radio receivers, alignment of low-frequency if amplifiers in TV receivers, and signal-tracing and trouble-shooting in TV receivers. Continuously tunable from 85 Kc to 30 Mc.

With the WR-49B you can inject rf signals into plate circuits and other points where dc is present without placing a dc load on circuit under test... with protection from burn-out in both equipment and signal generator. Width 10½", Height 7½", Depth 6¼".

- Cathode-follower output stage isolates oscillator from effects of load reactance and resistance, thereby maintaining good output waveform, voltage regulation, and frequency stability of the oscillator.
- Functional-design dial facilitates accurate, easy readings.
- Full-length shielding of output cable minimizes radiation and hum pickup.
- Built-in dc blocking capacitors.
- Built-in 400-cycle audio oscillator for internal modulation or as a separate signal source.

\$79.50* complete with shielded cable for rf or af output, instruction booklet.

*User Price (Optional)

COLOR-BAR GENERATOR

WR-61B



The WR-61B is essential for checking overall operation of color-TV receivers and for adjusting and trouble-shooting color phasing and matrixing circuits. The WR-61B generates the signals for producing 10 bars of different colors simultaneously, including bars corresponding to the R-Y, B-Y, G-Y, I and Q signals. The output signal consists of a picture carrier, color subcarrier, sync pulses, and an unmodulated sound carrier. All frequencies crystal-controlled for inherent accuracy and stability. Sound carrier can be switched off to check for sound interference, 189-Kc pedestals, adjustable in amplitude, permit checking of phasing and matrixing without the use of a scope. Luminance signals provided at edges of color bars for checking luminance and chrominance registration. Width 13½", Height 10", Depth 7½".

- Amplitude of color subcarrier and color-burst signal adjustable from front-panel for checking color sync-lock action of set.
- Both rf and video output available — video output has both "+" and "-" polarity.
- RF output at least 0.01 volt peak-to-peak; video output at least 0.25 volt peak-to-peak across 75 ohms; 8 volts peak-to-peak at HI video output.

\$259.50* includes rf and video output cables, TV-input adapter, instruction booklet.

*User Price (Optional)

TELEVISION / FM SWEEP GENERATOR

WR-69A



Tops for visual alignment of both TV and FM receivers, the all-new WR-69A has preset switch positions for all VHF TV channels, the FM broadcast band, and TV video, chrominance, and if frequencies. VHF output is on fundamental frequencies only; no beat notes or harmonics are used. Exceptionally good linearity is provided by a precision vibrator capacitor. Continuously adjustable sweep width and flat output make for accurate sweep-response portrayals. The new WR-69A is especially suited to alignment of color receivers. Special sample-voltage terminal on panel permits use with marker-adder units in alignment. Dual-piston attenuator provides smooth even attenuation over 60 db range. Width 13 $\frac{3}{8}$ ", Height 10", Depth 7".

- IF/Video output frequency continuously tunable from 50 Kc to 50 Mc.
- Sweep-frequency bandwidth continuously adjustable from 50 Kc to 20 Mc on if/video and fm — 12 Mc max. on TV channels.
- Return trace blanking.
- Two bias voltages available on front panel.

\$295.00* complete with RF Output cable, IF/Video Output cable and instruction booklet.

*User Price (Optional)

RF/IF/VF MARKER ADDER WR-70A



Designed for rf, if, and video sweep alignment of both color and black-and-white TV receivers, the WR-70A provides sharp, easy-to-read markers for alignment. The WR-70A is designed for use with conventional marker and sweep generators, such as the RCA WR-39, WR-89 and WR-99 series marker generators and the WR-59 and WR-69 series TV sweep generators.

With the WR-70A, the marker signal is added to the sweep-response curve after the sweep signal is taken out of the receiver under test. This eliminates or reduces distortion of sweep curve by the marker and permits trap alignment without marker "suckout." Provides four marker choices: positive peak, negative peak, positive and negative peaks (wide band), positive and negative peaks (narrow band) for discriminator alignment. Hi-Q markers are high in amplitude, narrow in width. Power supply voltage is stabilized for rock-steady trace display. Width 10½", Height 7½", Depth 6¼".

\$74.50* complete with cables and instruction booklet.
*User Price (Optional)

CRYSTAL-CALIBRATED MARKER GENERATOR

WR-99A



Versatility and accuracy highlight the all-new WR-99A Calibrator. Variable-frequency oscillator tunes from 19 to 260-Mc in 8 expanded ranges. Precise calibration obtainable at 1 and 10-Mc intervals throughout entire tuning range. All important sound- and picture-carrier frequencies, intermediate frequencies, and color-TV points are spotted on dial scales. Easy-to-read, spreadout dial scales and adjustable index pointer permit precise setting of frequency. Built-in speaker for zero-beat calibrating checks. Special socket at rear of WR-99A permits insertion of external crystal or L-C circuit into internal oscillator circuit to produce calibrating beats at special intervals. Wide choice of internal modulation for dual sound and picture markers, calibration beats, and for FM-detector alignment. Slide-switch attenuator for precise setting of output voltage level. Width 13½", Height 10", Depth 7".

\$242.50* complete with output cable, two phone tips and instruction booklet.

*User Price (Optional)

ELECTRON-TUBE MICROMHOMETER

WT-100A



The WT-100A is a laboratory instrument which measures tube characteristics, under actual operating-voltage and current conditions, with an accuracy comparable to that of tube manufacturers' equipment. Tests receiving-type and small transmitting tubes. Plug-in multiple-socket assemblies and 14-pin selector switches assure utmost flexibility for present and future requirements.

The WT-100A measures: true transconductance with an accuracy of better than $\pm 3\%$, both control-grid-to-plate and suppressor-grid-to-plate values; electrode currents—plate, screen grid, suppressor grid, and control-grid currents from 3 microamps full scale to 300 ma full scale; ac heater current; and voltage drop of vacuum and gas tubes, dry-disc rectifiers and crystal diodes. Width $23\frac{1}{2}$ ", Height 8", Depth $18\frac{1}{2}$ ".

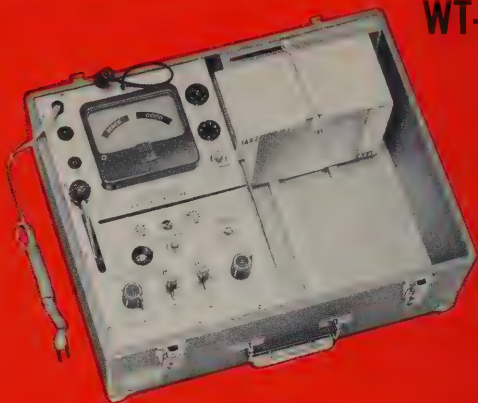
- Built-in gm calibrating circuit—no null meters or extra devices required.
- Built-in "shorts" test.
- Meter is burn-out proof, even on 3 microamp full-scale range.
- Regulated power supplies for dc voltages.
- 250-ma dc supply for filaments of battery-operated tube types.
- Measures gm up to 100,000 micromhos in 6 ranges.

\$1,075.00* complete with 4 multiple-socket plug-in units, instruction booklet, and tube data chart.

*User Price (Optional)

Automatic ELECTRON-TUBE TESTER

WT-110A



All-new in approach to fast, accurate tube testing, the WT-110A Automatic Electron-Tube Tester utilizes punched cards of heavy-duty plastic for automatic internal set-up of pin connections and test voltages. Complete transconductance test-set-up takes only seconds; cards are permanently hinged in case for convenient insertion into test slot. The WT-110A tests for gas, shorts, interelectrode leakage and over-all tube quality. Quality of tube indicated on "Renew-?-Good" meter scale. Tests 7-pin, 9-pin, octal, and lock-in types. Accessory sockets available (at additional cost) to test 4, 5, 6, 7-pin and subminiature types.

Simplified, automatic design speeds testing of diodes, triodes, and other multi-element tubes, as well as double- and triple-section tubes having similar or dissimilar sections. Designed especially for TV and general electron-tube service testing, the WT-110A punch-card system provides for flexibility and easy addition of cards for new tube types. Width 17¼", Height 6⅝", Depth 13¼".

WG-324A Gas Tube Adapter

\$2.95*

permits testing of gas tubes such as

0A2 — 0A3 — 0B2 — 0C2 — 0C3 — 0D3 — 0D4

Now being supplied at no additional cost — data booklet containing punching information for over 1,000 types.

\$199.50* complete with 1 set of 239 punched cards, 1 master punch-card, test card plus 24 additional punched cards, 24 unpunched cards, a card punch, and instruction booklets covering card-punching and tester information.

*User Price (Optional)



TEST EQUIPMENT

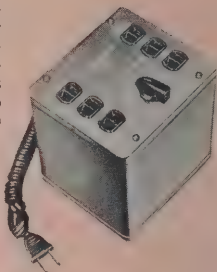
ACCESSORIES

These versatile RCA test equipment accessories are expertly engineered to give you an economical and convenient means of extending the range and usefulness of your test equipment. RCA test equipment accessories are available for most servicing applications. They are especially useful in applications involving very high dc voltages, high frequencies, high impedances, or other special measurements.

TV ISOTAP WP-25A

Speed up servicing, prevent damage to test equipment, minimize shock hazards, cut down costly returns. The WP-25A may be used as a high-medium-low isolation transformer for testing TV receivers at various settings of line voltage. Supplies outputs of 130, 115, and 105 volts at maximum load and is tapped to match line voltages from 105 to 130 volts in six steps.

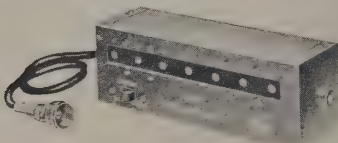
\$22.00*



VIDEO MULTIMARKER WG-295C

The WG-295C provides seven simultaneous absorption-type markers at accurately preset frequencies for marking video response curves in color receivers. Markers 0.5 Mc, 1.5 Mc, 2.5 Mc, 3 Mc, 3.58 Mc, 4.1 Mc, and 4.5 Mc. Each marker is identified simply by touching a corresponding contact on the WG-295C case. This reduces the amplitude of that particular marker. The WG-295C connects between the IF/VF output on the sweep generator and the video output cable.

\$32.50* with instruction bulletin.



*User Price (Optional)

HIGH-VOLTAGE PROBES

WG-289 and WG-297

The WG-289 extends the dc-voltage range of the WV-98A, WV-77A, WV-77B, WV-77C, WV-97A, WV-87A, and the WV-87B VoltOhmysts to 50,000 volts. The WG-297 extends the range of the WV-77E and the WV-77E(K) VoltOhmysts to 50,000 volts.

The WG-289 is provided with a microphone-type connector, and the WG-297 is provided with banana-plugs for use with the appropriate VoltOhmysts and other voltmeters.

WG-206 — 1090-megohm multiplier resistor for VTVM's having 11-megohm input (Multiplying factor 100)

WG-210 — 900-megohm resistor multiplies 5000-volt dc range of 20,000-ohms-per-volt VOM's by factor of 10

WG-211 — 495-megohm resistor multiplies 250-volt dc range of 20,000-ohms-per-volt VOM's by factor of 100

\$7.15* Probe only
WG-289 or WG-297

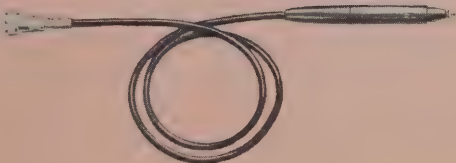
\$2.80* Multiplier Resistor only
WG-206, WG-210, or WG-211



DC/AC — OHMS PROBE AND CABLE WG-299D

The WG-299D is a slim, single-unit probe which includes a built-in finger-tip switch for instant selection of dc or ac/ohms operation. The probe, designed for use with VoltOhmysts, is completely shielded from connector-to-tip and is insulated to prevent accidental shorts, grounds and shocks. Replaces WG-217, WG-218 and WG-222 and WG-299C.

\$4.95*

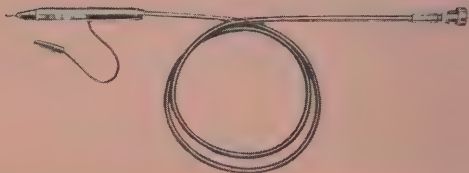


*User Price (Optional)

DIRECT/LOW-CAPACITANCE PROBE AND CABLE WG-300B

The WG-300B is a slim, sturdy, single-unit low-capacitance probe and cable designed for use with RCA Oscilloscopes. The cable is 48 inches long and is completely shielded from the microphone connector to the probe tip to minimize hum and stray field pick-up. A built-in switch provides instant selection of direct or low-capacitance operation. Input characteristics: 10 megohms resistance, 11 $\mu\mu\text{f}$ capacitance when used with the WO-91A. Includes ground lead and clip. Replaces WG-216A/B, WG-293 and WG-218.

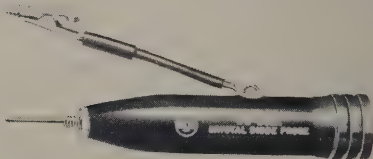
\$14.25*



CRYSTAL-DIODE PROBE WG-301A

"Slip-on" type for use with the WG-299C DC/AC-Ohms Probe and Cable extending the frequency range of *VoltOhmysts* to 250 Mc. When used with WG-299C, replaces WG-264.

\$7.75*



*User Price (Optional)

RF/IF/VF SIGNAL TRACING PROBE WG-302A

The WG-302A "slip-on" high-frequency probe is designed for use with the WG-300B probe and cable and the WO-91A Oscilloscope, to permit visual signal tracing for rapid isolation of trouble in radio receivers and in television *if* and video stages. When used with the WG-300B, replaces WG-291.

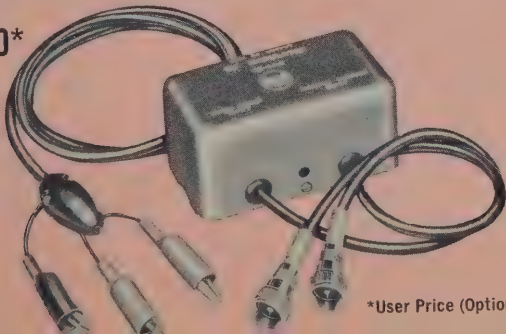
\$8.50*



WG-304B RF MODULATOR

The WG-304B is an accessory used to check the overall frequency response of TV receivers from antenna to picture tube grid. The unit permits modulation from a marker generator (such as WR-99A) by a signal from a video sweep generator (such as WR-69A).

\$12.50*

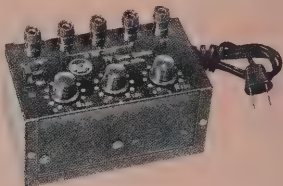


*User Price (Optional)

TV BIAS SUPPLY WG-307A

The RCA WG-307A TV Bias Supply provides four output voltages, and is designed for use in servicing and aligning color and black-and-white TV receivers. Three separate output voltages, adjustable from 0 to -15 volts are provided for application in rf, if, and agc bias circuits. A fourth output voltage, fixed at -100, volts is provided for use in the burst-keyer grid circuit of color-TV receivers during alignment tests of the chrominance circuitry. The WG-307A utilizes a power transformer and operates from 105-125 volts, 60 cps.

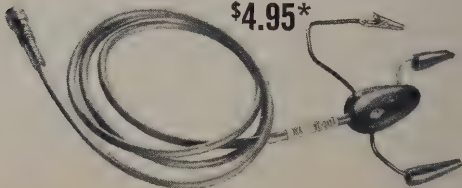
\$22.50*



DIRECT/LOW-CAPACITANCE PROBE WG-349A

The WG-349A is a 48-inch, small diameter, extremely flexible shielded cable designed for use with the WO-33A and WO-33A (K) Oscilloscopes. The probe consists of three short leads with alligator clips for ground, direct, and low-capacitance connections. For convenient use, the WG-349A eliminates the need for switching. It connects to the oscilloscope by means of a miniature-type microphone connector. Input characteristics: 10 megohms, 12 $\mu\mu\text{f}$ capacitance when used with the WO-33A and WO-33A (K).

\$4.95*

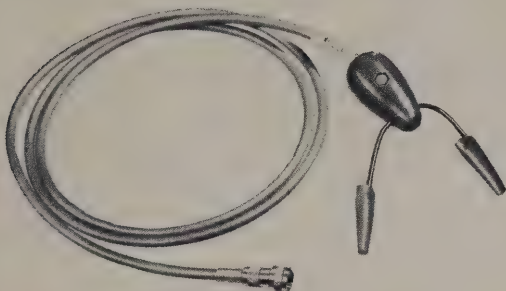


*User Price (Optional)

DEMODULATOR PROBE WG-350A

For use with the WO-33A Super-Portable Oscilloscope for demodulation and signal tracing of radio/TV rf and if signals.

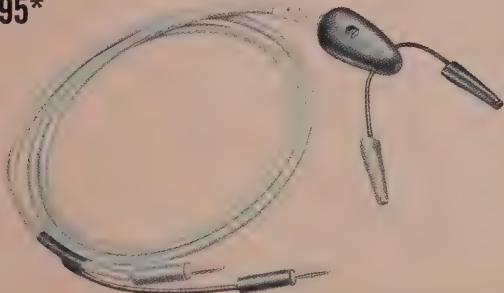
\$4.95*



CRYSTAL DIODE PROBE WG-351A

For extending the rf measuring capability of the WV-77E VoltOhmyst, and WV-77E-(K) VoltOhmyst Kit, to over 100 Mc.

\$4.95*



*User Price (Optional)

WG-324A	Gas Tube Adapter for WT-110A	\$2.95*
WG-325A	Accessory Unpunched Cards for WT-110A	\$2.25*
WG-326A	Accessory Card Punch for WT-110A	\$5.95*
WG-337A	Tube Socket Adapter Set	\$7.95*
WG-338A	Tube Socket Adapter	\$2.95*
WG-339A	Tube Socket Adapter	\$3.50*

AUTHORIZED  DISTRIBUTOR

ELECTRONIC INSTRUMENTS



RADIO CORPORATION OF AMERICA

ELECTRON TUBE DIVISION

HARRISON, N. J.

The ABCs of DMMs



FLUKE

What exactly is a digital multimeter (DMM) and what can it do? How should measurements be made? What features do you need? What is the safest and easiest way to get the most out of your meter? These are the questions that this booklet will answer for you.

Work Safely

This brochure is a general guide for DMMs. It is not intended to replace or be a substitute for the instruction manuals supplied with your multimeter. Fluke cannot anticipate all possible precautions that you must take on all the different DMMs and equipment for which this brochure is applicable.

You should read and understand the instruction manuals for your particular meter before you begin using it. Take special notice of all safety precautions and warnings in the instruction manuals. Also, observe all points of safety, indicated by the Δ symbol in this booklet.

This booklet is not intended as a tutorial on electrical theory. It assumes basic electrical and electronic knowledge on the part of the reader.

Technology is rapidly changing the way things work. Cars have on-board computer systems, electric motors are controlled by electronic drives, and electronic circuits are used in everything from coffee makers to spacecraft. Servicing, repairing and installing this complex equipment requires diagnostic tools that will give you accurate information.

Let's begin by explaining what a DMM is. A DMM is simply an electronic ruler for making electrical measurements. It may have any number of special features, but mainly a DMM measures volts, ohms and amperes.

Fluke DMMs are used for examples in this booklet. Other DMMs may operate differently or offer different features from the ones shown. However, this booklet explains common uses and tips for using most DMMs. In the next few pages you will see how to use a DMM to make measurements and how DMMs differ from one another.

Choosing Your DMM

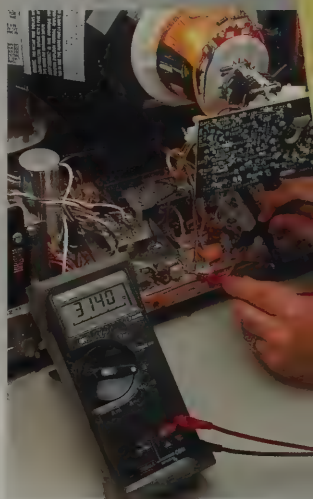
Buying a DMM requires not only looking at basic specifications, but also looking at features, functions and the overall value represented by a meter's design and care taken in its production.

Reliability, especially under tough conditions, is more important than ever today. So, by the time Fluke DMMs are ready to be

tossed into toolcases, they've undergone a rigorous testing and evaluation program.

User safety is a primary consideration when Fluke DMMs are designed. All Fluke handheld DMMs are UL listed for safety.

Fluke offers many DMMs with different combinations of features like Touch Hold®, analog bar graphs, and enhanced resolution. Accessories for high current and temperature measurements are available to extend the capabilities of your DMM. See the back page of this booklet for more information on Fluke DMMs and accessories.

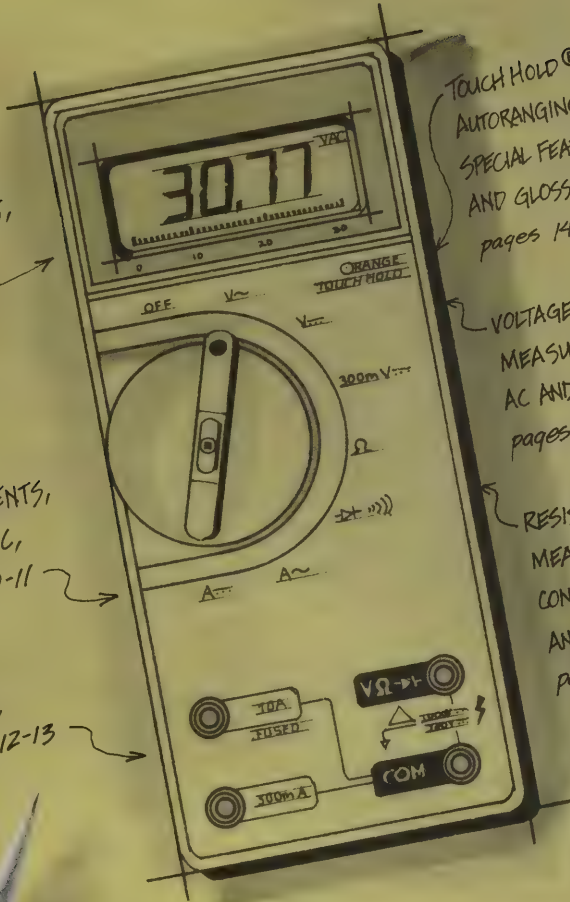


DIGITAL MULTIMETER BASICS

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Resolution, Digits and Counts

Resolution refers to how small or fine a measurement the meter can make. By knowing the resolution of a DMM you can determine whether the meter could measure down to only 1 volt or down to 1 millivolt (1/1000th of a volt).

You wouldn't buy a ruler marked in one inch segments (or centimeters) if you had to measure down to 1/4 inch (or one millimeter). A thermometer that only measured in whole degrees isn't much use when your normal temperature is 98.6°F. You need a thermometer with 1° resolution.

The terms *digits* and *counts* are used to describe a meter's resolution. DMMs are grouped by the number of counts or digits they display.

A 3 1/2 digit meter can display three full digits ranging from 0 to 9, and one "half" digit which displays only a 1 or is left blank. A 3 1/2 digit meter will display up to 1999 counts of resolution. A 4 1/2 digit meter can display up to 19,999 counts of resolution.

It is more precise to describe a meter by counts of resolution rather than 3 1/2 or 4 1/2 digits. Today's 3 1/2 digit meters may have enhanced resolution of up to 3200 or 4000 counts.

Meters with more counts offer better resolution for certain measurements. For example, a 1999 count meter won't be able to measure down to a tenth of a volt if you are measuring 200 volts or

more. However, a 3200 count meter will display a tenth of a volt up to 320 volts. This is the same resolution as a more expensive 20,000 count meter until you exceed 320 volts.

Accuracy

Accuracy is the largest allowable error that will occur under specific operating conditions. In other words, it is an indication of how close the DMM's displayed measurement is to the actual value of the signal being measured.

Accuracy for a DMM is usually expressed as a *percent of reading*. An accuracy of $\pm 1\%$ of reading means that for a displayed reading of 100.0V, the actual value of the voltage could be anywhere between 99.0V to 101.0V.

Specifications may also include a range of digits added to the basic accuracy specification. This indicates how many counts the digit to the extreme right of the display may vary. So the accuracy example from above might be stated as $\pm(1\% + 2)$. Therefore, for a display reading of 100.0V the actual voltage would be between 98.8V and 101.2V.

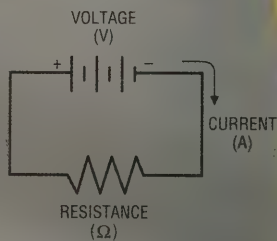
Analog meter specifications are determined by the error *at full scale*, not at the displayed reading. Typical accuracy for an analog meter is $\pm 2\%$ or $\pm 3\%$ of *full scale*. Typical basic accuracy for a DMM is $\pm(0.7\% + 1)$ to $\pm(0.1\% + 1)$ of *reading*, or better.

Ohm's Law

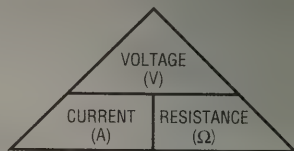
Voltage, current, and resistance in any electrical circuit can be calculated by using Ohm's Law, which

states that voltage = current X resistance. Thus, if any two values in the formula are known, the third can be determined.

A DMM makes use of the principle of Ohm's Law to directly measure and display either ohms, amps, or volts. In the next pages you will see just how easy it is to use a DMM to find the answers you need.



DMMs measure the three elements of Ohm's Law: voltage (V), current (A), and resistance (Ω).



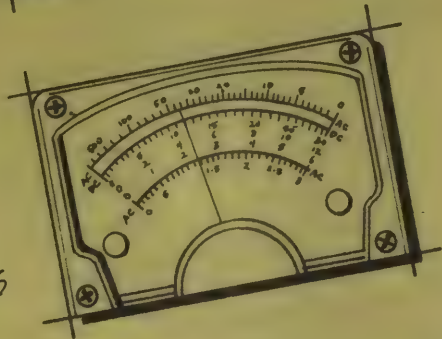
Ohm's Law explains the relationship between voltage, current and resistance. Put your finger over the value you want to find. Multiply the remaining values if side-by-side; divide if one is over the other. But it really is much easier just to use your DMM.

DIGITAL AND ANALOG DISPLAYS

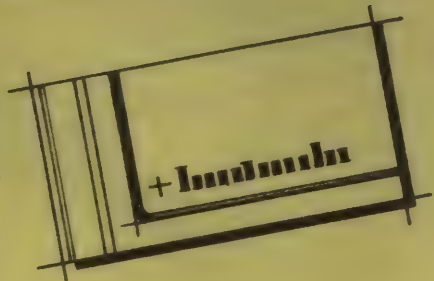
FOR HIGH ACCURACY AND RESOLUTION, THE DIGITAL DISPLAY EXCELS, DISPLAYING THREE OR MORE DIGITS FOR EACH MEASUREMENT.



THE ANALOG NEEDLE DISPLAY IS LESS ACCURATE AND HAS LOWER EFFECTIVE RESOLUTION SINCE YOU HAVE TO ESTIMATE VALUES BETWEEN THE LINES.



A BAR GRAPH SHOWS CHANGES AND TRENDS IN A SIGNAL JUST LIKE AN ANALOG NEEDLE, BUT IS MORE DURABLE AND LESS PRONE TO DAMAGE.

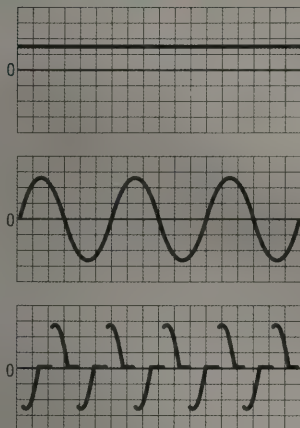


Measuring Voltage

One of the most basic tasks of a DMM is measuring voltage. A typical dc voltage source is a battery, like the one used in your car. AC voltage is usually created by a generator. The wall outlets in your home are common sources for ac voltage. Some devices convert ac to dc. For example, electronic equipment such as TVs, stereos, VCRs and computers that you plug into an ac wall outlet use devices called rectifiers to convert the ac voltage to a dc voltage. This dc voltage is what powers the electronic circuits in these devices.

Testing for proper supply voltage is usually the first thing measured when troubleshooting a circuit. If there is no voltage present, or if it is too high or too low, the voltage problem should be corrected before investigating further.

The waveforms associated with ac voltages are either sinusoidal (sine waves), or non-sinusoidal (sawtooth, square, ripple, etc.). DMMs display the "rms" value (root-mean-square) of these voltage waveforms. The rms value is the effective or equivalent dc value of the ac voltage.



Three voltage signals: dc, ac sine wave, and non-sinusoidal ac signal.

Most meters, called "average responding," give accurate rms readings if the ac voltage signal is a pure sine wave. Averaging meters are not capable of measuring non-sinusoidal signals accurately. Special DMMs called "true-rms" DMMs will accurately measure the correct rms value, regardless of the waveform, and should be used for non-sinusoidal signals.

A DMM's ability to measure ac voltage can be limited by the frequency of the signal. Most

DMMs can accurately measure ac voltages with frequencies from 50 Hz to 500 Hz, while others can measure ac voltages with frequencies from 20 Hz to 100 kHz. DMM accuracy specifications for ac voltage and ac current should state the frequency range of a signal the meter can accurately measure.

Voltage measurements determine:

- 1) Source voltage
- 2) Voltage drop
- 3) Voltage imbalance



Accessories, such as Fluke 80k-6 and 80k-40 high voltage probes, extend the voltage measurement range of a DMM.



HOW TO MAKE VOLTAGE MEASUREMENTS

NOTE: $\frac{1}{1000} V = 1 \text{ mV}$
 $1000 V = 1 \text{ kV}$

1. SELECT VOLTS AC ($V\sim$), VOLTS DC ($V=$) OR 300mV \equiv AS DESIRED.

2. PLUG THE BLACK TEST PROBE INTO THE COM INPUT JACK. PLUG THE RED TEST PROBE INTO THE V INPUT JACK

3. TOUCH THE PROBE TIPS TO THE CIRCUIT ACROSS A LOAD OR POWER SOURCE AS SHOWN (IN PARALLEL TO THE CIRCUIT). ⚠

4. VIEW THE READING, BEING SURE TO NOTE THE UNIT OF MEASUREMENT.

NOTE: FOR DC READINGS OF THE CORRECT POLARITY (+/-), TOUCH THE RED TEST PROBE TO THE POSITIVE SIDE OF THE CIRCUIT, AND THE BLACK PROBE TO THE NEGATIVE SIDE OR CIRCUIT GROUND. IF YOU REVERSE THE CONNECTIONS, A DMM WITH AUTO POLARITY WILL MERELY DISPLAY A MINUS SIGN INDICATING NEGATIVE POLARITY. WITH AN ANALOG METER YOU RISK DAMAGING THE METER.



Special high voltage probes are available for TV and CRT repair where voltages can reach 40 kV. CAUTION: These probes are not intended for electrical utility applications in which high voltage is also accompanied by high energy. Rather, they are intended for use in low energy applications.

Resistance

Resistance is measured in ohms (Ω). Resistance values can vary greatly, from a few milliohms ($m\Omega$) for contact resistance to billions of ohms for insulators. Most DMMs measure down to 0.1Ω ; some measure as high as $300 M\Omega$ (300,000,000 ohms). Infinite resistance is read as "OL" on the Fluke meter display, and means the resistance is greater than the meter can measure. Open circuits will read "OL" on the meter's display.

Resistance measurements must be made with the circuit power off, otherwise damage to the meter and the circuit may result. Some DMMs provide protection in the ohms mode in case of accidental contact with voltages. The level of protection may vary greatly between different DMM models.

For accurate low resistance measurements, resistance in the test leads must be subtracted from the total resistance measured. Typical test lead resistance is between 0.2Ω and 0.5Ω . If the resistance in the test leads is greater than 1Ω they should be replaced.

If the DMM supplies less than $0.3V$ dc test voltage for measuring resistance, it will be able to measure the values of resistors that are isolated in a circuit by diodes or semiconductor junctions. This often allows you to test resistors on a circuit board without unsoldering them.

Resistance measurements determine:

- 1) Resistance of a load
- 2) Resistance of conductors
- 3) Value of a resistor
- 4) Operation of a variable resistor

Continuity

Continuity is a quick go/no-go resistance test that distinguishes between an open and a closed circuit.

A DMM with a continuity beeper allows you to complete many continuity tests easily and quickly. The meter beeps when it detects a closed circuit, so you don't have to look at the meter as you test. The level of resistance required to trigger the beeper varies from model to model of DMM.

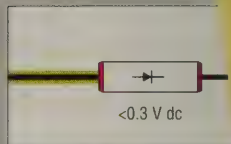
Continuity tests determine:

- 1) Good or blown fuse
- 2) Open or shorted conductors
- 3) Operation of switches
- 4) Circuit paths (by circuit or conductor tracing)

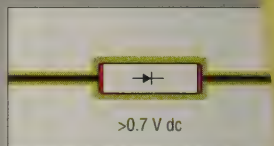
Diode Test

A diode is like an electronic switch. It can be turned on if the voltage is over a certain level, generally about $0.3V$ for a silicon diode, and allows current to flow in one direction.

Some meters have a special mode called diode test. In this mode the readings across the diode should be $0.6V$ to $0.7V$ in one direction, and indicate an open circuit in the other. This indicates a good diode. If both readings are open circuit the diode is open, if both readings indicate continuity the diode is shorted.



For measuring resistance in the presence of diodes, DMM test voltages are kept below $0.3V$ so that the semiconductor junctions are not turned on.



Select diode test and the test voltages are raised so the operation of diodes and semiconductor junctions can be checked.



HOW TO MAKE RESISTANCE MEASUREMENTS

NOTE: $1,000\Omega = 1\text{ k}\Omega$
 $1,000,000\Omega = 1\text{ M}\Omega$

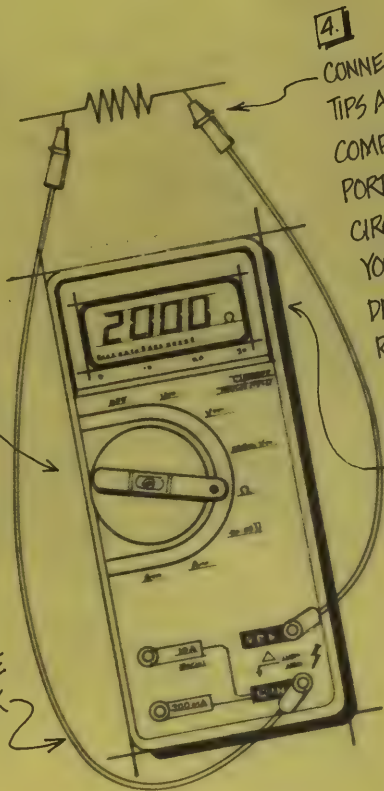
1. TURN OFF POWER TO THE CIRCUIT. ⚠

2. SELECT RESISTANCE (Ω).

3. PLUG THE BLACK TEST PROBE INTO THE COM INPUT JACK. PLUG THE RED TEST PROBE INTO THE Ω INPUT JACK

4. CONNECT THE PROBE TIPS ACROSS THE COMPONENT OR PORTION OF THE CIRCUIT FOR WHICH YOU WANT TO DETERMINE RESISTANCE.

5. VIEW THE READING, BEING SURE TO NOTE THE UNIT OF MEASUREMENT-- OHMS (Ω), KILOHMS ($\text{k}\Omega$), OR MEGOHMS ($\text{M}\Omega$).



Make sure the power is off before making resistance measurements.

Measuring Current

Current measurements are different from other measurements made with a DMM. Current measurements are made in series, unlike voltage or resistance measurements, which are made in parallel. The entire current being measured flows through the meter. Also, the test leads must be plugged into a different set of input jacks on the meter.

Current measurements determine:

- 1) Circuit overloads
- 2) Control circuit current (4-20 mA current loop)
- 3) Circuit operating current
- 4) Current in different branches of a circuit

Input Protection

A common mistake is to leave the test leads plugged into the current input jacks and then attempt a voltage measurement. This causes a direct short across the source voltage through a low-value resistor inside the DMM, called a current shunt. A high current flows through the DMM and, if the meter is not adequately protected, can cause extreme damage to the meter and to the circuit, and injury to the operator. Extremely high fault currents can occur if industrial high voltage circuits are involved (480 volts or higher).

A DMM should have current input fuse protection of high enough capacity for the circuit being measured. Meters without fuse protection in the current inputs should not be used on high energy electrical circuits (>240V ac). Those DMMs that do use fuses should have a fuse with

sufficient capacity to clear a high energy fault. The voltage rating of the meter's fuses should be greater than the maximum voltage you expect to measure. For example, a 20 amp, 250 volt fuse may not be able to clear a fault inside the meter when the meter is across a 480 volt circuit. A 20 amp, 600 volt fuse would be needed to clear the fault on a 480 volt circuit.

Current Probe Accessories

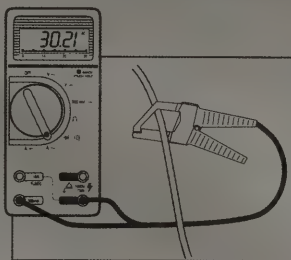
Sometimes you may have to make a current measurement that exceeds the rating of your DMM. In these higher current applications (typically over 2 amps) where extremely high accuracy is not needed, a current probe is very useful. A current probe clamps around the conductor carrying the current, and converts the measured value to a level the meter can handle.

There are two basic types of current probes; current transformers, which measure ac current

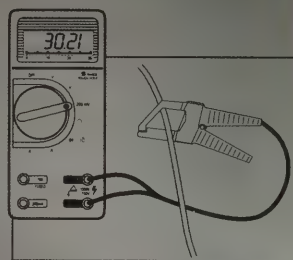
only, and Hall-Effect probes, which measure ac or dc current.

The output of a current transformer is *1 milliamp per amp*. A 100 amp value is reduced to 100 milliamps, which can be safely measured by most DMMs. The probe leads are connected to the "mA" and "Common" input jacks, and the meter function switch is set to mA ac.

The output of a Hall-Effect probe is *1 millivolt per amp, ac or dc*. For example, 100 amps ac is converted to 100 mV ac. The probe leads are connected to the "V" and "Common" jacks. Set the meter function switch to the "V" or "mV" scale, selecting Vac for ac current or Vdc for dc current measurements.



A transformer-type current probe, such as the Fluke 80i-400, scales down the current being measured. The DMM displays 1 mA for every amp being measured.



The Fluke 80i-1010 Hall-Effect probe safely measures high-current ac or dc values by scaling down the current being measured and converting this reduced current to voltage. The meter displays 1 mV for every amp measured.

HOW TO MAKE CURRENT MEASUREMENTS

1.

TURN OFF THE POWER TO THE CIRCUIT ⚠

2.

CUT OR UNSOLDER THE CIRCUIT, CREATING A PLACE WHERE THE METER PROBES CAN BE INSERTED

3.

SELECT AMPS AC (A~), OR AMPS DC (A---) AS DESIRED

4.

PLUG THE BLACK TEST PROBE INTO THE COM INPUT JACK. PLUG THE RED TEST PROBE INTO THE 10 AMP (10A) OR 300 MILLIAMP (300mA) INPUT JACK DEPENDING ON THE EXPECTED VALUE OF THE READING.

5.

CONNECT THE PROBE TIPS TO THE CIRCUIT ACROSS THE BREAK AS SHOWN SO THAT ALL CURRENT WILL FLOW THROUGH THE METER (A SERIES CONNECTION).

6.

TURN THE CIRCUIT POWER BACK ON.

7.

VIEW THE READING, BEING SURE TO NOTE THE UNIT OF MEASUREMENT.

NOTE: IF TEST LEADS ARE REVERSED, A (-) SIGN WILL SHOW IN THE DISPLAY.



Always make sure the power is off before cutting or unsoldering the circuit and inserting the DMM for current measurements. Even small amounts of current can be dangerous.



Never attempt a voltage measurement with the test probes in the current jacks. Meter damage or personal injury may result!

Multimeter Safety

Making measurements safely begins with following good measurement procedures. Regularly check your meter for correct operation, signs of wear, and be aware of high voltage / high current situations.

Different DMMs have different types of protective circuitry. The more protection your meter has the more your investment is protected and the longer it will stay on the job.

Common Situations that Lead to DMM Failure:

- 1) Contact with ac power source while test leads are plugged into current jacks
- 2) Contact with ac power source while in resistance mode
- 3) Exposure to high voltage transients
- 4) Exceeding maximum input limitations (voltage and current)

Types of DMM Protection Circuits:











- 1) Protection with automatic recovery — Some meters have circuitry that detects an overload condition and protects the meter until the condition no

longer exists. After the overload is removed the DMM automatically returns to normal operation. Usually used to protect the ohms function from voltage overloads.

- 2) Protection without automatic recovery — Some meters will detect an overload condition and protect the meter but will not recover until the operator performs an operation on the meter, such as replacing a fuse.

Look for these safety features in a DMM:

- 1) Fused current inputs
- 2) Use of high energy fuses (600V or more)
- 3) High voltage protection in resistance mode (500V or more)
- 4) Protection against voltage transients (6kV or more)
- 5) Safety designed test leads with finger guards and shrouded terminals
- 6) Independent safety organization approval/listing (i.e. UL, CSA etc.)

	OFF (power) SWITCH POSITION
	ON (power) SWITCH POSITION
	AC – ALTERNATING CURRENT
	DC – DIRECT CURRENT
	EITHER DC OR AC
	DANGEROUS
	GROUND
	SEE EXPLANATION IN MANUAL
	DOUBLE INSULATION (Protection Class II)
	FUSE

	Underwriters Laboratories Inc., U.S.A.
	Factory Mutual Research Corp., U.S.A.
	Canadian Standards Association, Canada
	Technischer Überwachungsverein Rheinland
	Verband Deutscher Elektrotechniker (VDE) Germany
	UL recognition mark

SAFETY CHECKLIST

- ✓ USE A METER THAT MEETS ACCEPTED SAFETY STANDARDS.
- ✓ USE A METER WITH FUSED CURRENT INPUTS AND BE SURE TO CHECK THE FUSES BEFORE MAKING CURRENT MEASUREMENTS.
- ✓ INSPECT TEST LEADS FOR PHYSICAL DAMAGE BEFORE MAKING A MEASUREMENT.
- ✓ USE THE METER TO CHECK CONTINUITY OF THE TEST LEADS.
- ✓ ONLY USE TEST LEADS THAT HAVE SHROUDED CONNECTORS AND FINGER GUARDS.
- ✓ ONLY USE METERS WITH RECESSED INPUT JACKS.
- ✓ SELECT THE PROPER FUNCTION AND RANGE FOR YOUR MEASUREMENT.
- ✓ BE CERTAIN THE METER IS IN GOOD OPERATING CONDITION.
- ✓ FOLLOW ALL EQUIPMENT SAFETY PROCEDURES.
- ✓ ALWAYS DISCONNECT THE "HOT" (RED) TEST LEAD FIRST.
- ✓ DON'T WORK ALONE.
- ✓ USE A METER WHICH HAS OVERLOAD PROTECTION ON THE OHMS FUNCTION.
- ✓ WHEN MEASURING CURRENT WITHOUT A CURRENT CLAMP, TURN THE POWER OFF BEFORE CONNECTING INTO THE CIRCUIT.
- ✓ BE AWARE OF HIGH CURRENT AND HIGH VOLTAGE SITUATIONS AND USE THE APPROPRIATE EQUIPMENT SUCH AS HIGH VOLTAGE PROBES AND HIGH CURRENT CLAMPS.



Meter ratings and capabilities vary by manufacturer. Before working with a new meter, be sure to familiarize yourself with all operating and safety procedures for that meter contained in the user's manual.

Accessories

One very important feature of a DMM is that it can be used with a wide variety of accessories. Many accessories are available that can increase your DMM's measurement range and usefulness, while making your measurement tasks easier.

High voltage probes and current probes scale down high voltages and currents to a level the DMM can safely measure. Temperature probes convert your DMM into a handy digital thermometer. RF probes can be used to measure voltages at high frequencies.

A selection of test leads, test probes and test clips are available for replacement and to help you easily connect your DMM to the circuit. Soft and hard carrying cases protect your DMM and conveniently store your accessories with your DMM.

Glossary

Accuracy. How closely the DMM's displayed measurement is to the actual value of the signal being measured. Expressed as a percentage of reading or as a percentage of full scale (pg 4).

Analog meter. An instrument that uses a needle movement to display the value of a measured signal. The user judges the reading based on the position of the needle on a scale (pg 5).

Annunciator. A symbol that identifies a selected range or function (pg 15).

Average Responding DMM. A DMM that accurately measures sinusoidal waveforms, while measuring non-sinusoidal waveforms with less accuracy (pg 6).

Count. A number used to specify a DMM's resolution (pg 4).

Current-shunt. A low-value resistor in a DMM for measuring current. The DMM measures the voltage drop across the current shunt and, using Ohm's Law, calculates the value of the current (pg 10).

DMM, Digital Multimeter. An instrument that uses a digital display to show the value of a measured signal. DMMs feature greater durability, resolution, and far more accuracy than analog meters (pg 2).

Non-sinusoidal waveform. A distorted waveform such as a pulse train, square waves, triangular waves, sawtooth waves and spikes (pg 6).

Resolution. The degree to which small changes in a measurement can be displayed (pg 4).

RMS. The equivalent dc value of an ac waveform (pg 6).

Sinusoidal waveform. A pure sine wave without distortion (pg 6).

True-rms DMM. A DMM that can accurately measure both sinusoidal and non-sinusoidal waveforms (pg 6).



SPECIAL FEATURES

THE FOLLOWING SPECIAL FEATURES MAKE IT EASIER TO USE YOUR DMM.

LOW-BATTERY INDICATOR

AUTOPOLARITY INDICATES
NEGATIVE READINGS
WITH A MINUS SIGN
SO EVEN IF YOU
CONNECT THE TEST
LEADS IN REVERSE
YOU WON'T DAMAGE
THE METER.

AUTORANGING
AUTOMATICALLY SELECTS
PROPER MEASUREMENT
RANGE. MANUAL
RANGING LETS YOU LOCK
INTO A SPECIFIC RANGE
FOR REPETITIVE
MEASUREMENTS.

SPECIAL HIGH-ENERGY
FUSES PROVIDE EXTRA
PROTECTION FOR USER

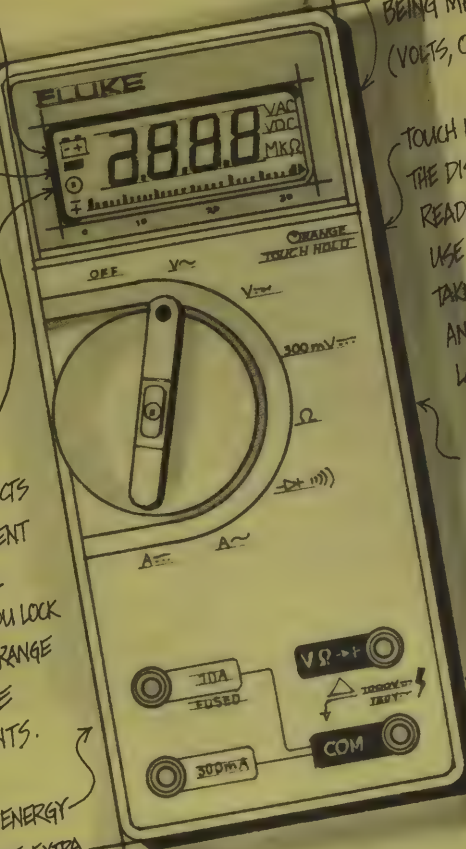
AND METER DURING CURRENT
MEASUREMENTS AND
OVERLOADS.

ANNUNCIATORS SHOW
AT A GLANCE WHAT IS
BEING MEASURED
(VOLTS, OHMS, ETC.)

TOUCH HOLD® FREEZES
THE DISPLAY ON STABLE
READINGS SO YOU CAN
USE BOTH HANDS TO
TAKE A MEASUREMENT
AND VIEW RESULTS
LATER.

ONE SWITCH OPERATION
MAKES IT EASY TO
SELECT MEASUREMENT
FUNCTIONS.

OVERLOAD PROTECTION
PREVENTS DAMAGE
TO BOTH THE METER
AND THE CIRCUIT,
AND PROTECTS
THE USER.



Faber-Castell

The information in this booklet covers basic digital multimeter functions, such as those found on the Fluke 70 Series and the Fluke 21 and 23. Fluke also makes a variety of other DMMs with specialized features and functions for a wide range of applications.

To learn more about Fluke Digital Multimeters, ask your distributor for the following brochures and application notes:

Fluke Distributor Catalog
Fluke Guide to High Performance Multimeters

Beat the Book with Fluke Multimeters (Automotive Troubleshooting)

Electrical Troubleshooting with Fluke Multimeters

HVAC & R Systems — Service Tips with Fluke Thermometers and Multimeters

Analog Bar Graph Applications Using Fluke 70 Series Multimeters

Fluke multimeters are available from leading distributors worldwide. For the name of your nearest distributor call toll-free **1-800-44-FLUKE** (1-800-443-5853) in the U.S.A., 416-890-7600 in Canada, or 206-356-5600 from other countries.



Fluke 73

Analog/Digital display
Volts, ohms, 10A, diode test
0.7% basic dc accuracy
Autorange
2000+ hour battery life
3-year warranty



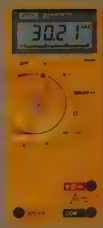
Fluke 75

Analog/Digital display
Volts, ohms, 10A, mA, diode test
0.5% basic dc accuracy
Audible continuity
Autorange/range hold
2000+ hour battery life
3-year warranty



Fluke 77

Analog/Digital display
Volts, ohms, 10A, mA, diode test
0.3% basic dc accuracy
Touch Hold
Audible continuity
Autorange/range hold
2000+ hour battery life
Multipurpose holster
3-year warranty



Fluke 21

Analog/Digital display
Volts, ohms, mA, diode test
0.5% basic dc accuracy
Audible continuity
Autorange/range hold
2000+ hour battery life
3-year warranty



Fluke 23

Analog/Digital display
Volts, ohms, 10A, mA, diode test
0.3% basic dc accuracy
Touch Hold
Audible continuity
Autorange/range hold
2000+ hour battery life
Multipurpose holster
3-year warranty



Fluke 25, 27

Analog/Digital display
Volts, ohms, 10A, mA, diode test
0.1% basic dc accuracy
Touch Hold
-15°C to +55°C operation
Ruggedized, waterproof case
Relative mode (27)
Min/Max recording mode (27)
3-year warranty



8060A, 8062A

19,999 count digital display
Volts, ohms, 2A, mA, diode test
0.04% and 0.5% basic dc accuracy
True-rms ac voltage and current
Continuity and diode test
Relative reference
Frequency, dBm, relative dB (8060A)
1-year warranty



Fluke 83, 85, 87

Analog/Digital display
Volts, ohms, 10A, mA, diode test
0.1% basic dc accuracy (0.3% for 83)
Touch Hold and Relative modes
Min, Max, Average recording
Frequency, duty cycle, capacitance
Input Alert™
True-rms (87 only)
Protective holster, Flex-Stand™
3-year warranty

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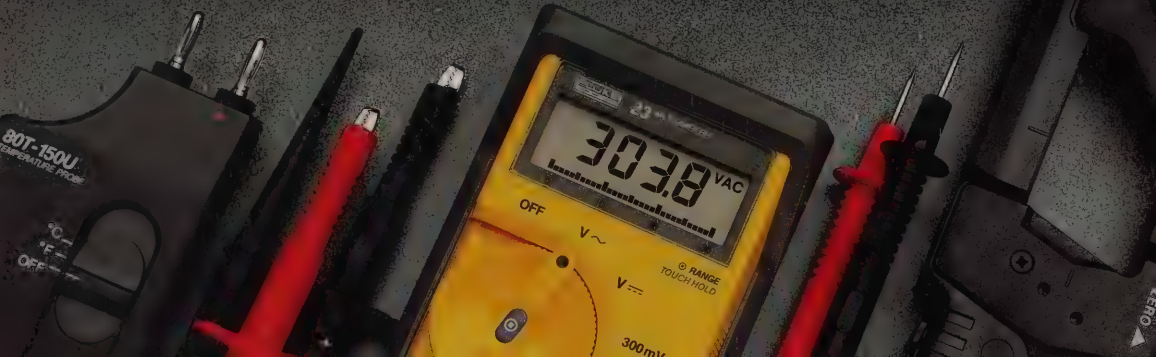
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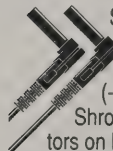
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FLUKE AND PHILIPS - THE GLOBAL ALLIANCE IN TEST & MEASUREMENT

FLUKE DMM ACCESSORIES




TL22 Flexible Test Leads




Superior flexibility and heat resistance from -100°C to $+300^{\circ}\text{C}$ (-148°F to $+572^{\circ}\text{F}$). Shrouded right-angle connectors on both ends. 63" (1.6m). 1000V, 10A maximum. One red, one black.

TL24 Flexible Test Leads – Straight



Same as TL22 except that one end has a shrouded, straight connector. One red, one black.

TL26 5-Way Multipoint Test Lead Set



Connects 5 ways: 1) to blade-shaped terminals 2) to screw heads or bare wire 3) to threaded or wire-wrapped terminals 4) Needles to pierce small gauge (#22-#28 AWG) wires 5) Needle to pierce larger gauge wires. 60" (1.5m), silicone-insulated leads, useable from -100°C to $+300^{\circ}\text{C}$ (-148°F to $+572^{\circ}\text{F}$). Shrouded right-angle connector. **250V, 10A maximum.** One red, one black.

One year warranty on all accessories.


TL28 2-Way Clip Test Lead Set




Solid, spring-loaded copper clips with a wide .50" (12.7 mm) jaw opening and serrated teeth. Large needle for piercing insulation. 60" (1.5m), silicone-insulated leads, useable from -100°C to $+300^{\circ}\text{C}$ (-148°F to $+572^{\circ}\text{F}$). Shrouded right angle connector. **250V, 10A maximum.** One red, one black.

Fuses


(not shown) Replacement fuses for Fluke DMMs are available from your distributor in 630 mA, 1A, 2A, 3A, and 15A values.

TL20 Industrial Test Lead Set

Set consists of silicone-insulated TL22 Test Leads (one red and one black), stainless-steel TP20 Industrial Test Probes (one red, one black), and AC20 Industrial Alligator Clips (one red, one black). 1000V, 10A maximum. Shrouded right-angle connectors.


TL70 Right-Angle Test Lead Set

Safety-shrouded right-angle inputs. 48" (1.2m). 1500V, 10A maximum. One red, one black.

Y8132 Replacement Lead Set

Straight, shrouded banana plugs on both ends. Detachable, standard point tips. 48" (1.2m). 1500V, 10A maximum. One red, one black.

Y8131 Replacement Lead Set (not shown). Similar to Y8132. Exposed banana plugs on one end.

Y8140 Slim-Flex Test Lead Set

Slim, adjustable length needle-point test leads will pierce varnish and thin insulation. 48" (1.2m). Exposed banana plugs. 1000V, 2A maximum. One red, one black.

Y8134 Shrouded Test Lead Kit

Interchangeable tips: 2 alligator clips, 2 spade lugs, 1 retractable hook tip, and 2 standard pointed tips. Shrouded banana plugs, C75 carrying pouch.

Y8133 Standard Test Lead Kit (not shown).

Similar to Y8134 kit, but with exposed banana plugs. For 8010A and 8012A.

A81 Battery Eliminator



For Fluke 37, 8020B and 8060A Series DMMs.

Permits line operation of DMMs without discharging their disposable batteries.

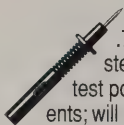
80T-H Touch and Hold Probe



For use with Fluke 8010A, 8012A, or 8050A. Direct signal-through test probe with a touch and hold feature.

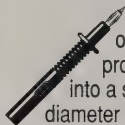
Touch button to hold volt or ohm reading. Operator can devote full attention to measurement being made, then view reading on DMM.

TP20 Industrial Test Probes



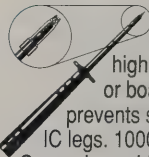
Very sharp, extra-long .750" (19 mm) stainless steel tip. For reaching deep test points or recessed components; will pierce insulation. 1000V, 10A maximum. One red, one black.

TP22 Banana-Plug Test Probe



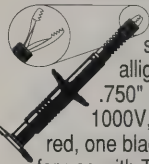
Safety-designed, plug-on test probes. European probe tip can be plugged into a standard .160" (4 mm) diameter banana jack. 1000V, 10A maximum. One red, one black.

TP80 Electronic Test Probe




Designed for electronic probing of high density components or boards. IC insulator cap prevents shorting of adjacent IC legs. 1000V, 10A maximum. One red, one black.

AC20 Industrial Test Clips




Safety-designed, spring-loaded alligator clips with a wide .750" (19 mm) jaw opening. 1000V, 10A maximum. One red, one black. Recommended for use with TL22 Test Leads.

AC70 Alligator Clips



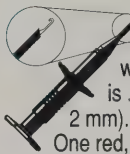
Slip-on alligator clips for TL70 Test Leads and other standard point probes. Standard .313" (8 mm) jaw opening. 1000V, 10A maximum. Two red, two black.

AC75 Banana-Jack Alligator Clips



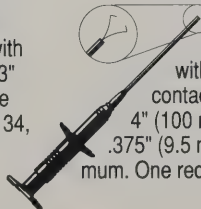
Insulated alligator clips with banana jacks. Standard .313" (8mm) jaw opening. Compatible with test leads Y8131 through Y8134, and TL24. 1000V, 10A maximum. Two red, two black.

AC80 Hook-Style Test Clips




Safety-designed, spring-loaded clips with hook grip. Hook size is .400" x .080" (10 mm x 2 mm). 1000V, 3A maximum. One red, one black.

C83 Pin-Grabber Test Clips




Spring-loaded pin-grabber hooks for use with test points in close contact areas. Shaft length is 4" (100 mm), grabber extends .375" (9.5 mm). 1000V, 1A maximum. One red, one black.

AC85 Large Jaw Alligator Clips



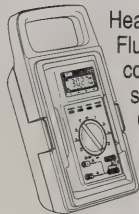
Fully insulated banana-jack alligator clips. Large .750" (20mm) jaw opening. **250V, 10A maximum.** One red, one black.

AC89 Insulation Piercing Clip



Clamp-type test probe has spring loaded stainless steel tip for piercing insulated wires. Pierces insulated wires from 30 AWG (.25 mm²) to 14 AWG (1.5 mm²). **250V, 5A maximum.** A single probe per package.

C20 Hard Case



Heavy duty case for Fluke 25 and 27. Top cover snaps on back to serve as tilt stand. Carrying handle and storage compartment for test leads and small accessories are part of case.

C25 Ruggedized Soft Case



For Fluke 25 or 27 or other Fluke handheld meters including Fluke 21, 23, 50 or 70 Series meters in C70 Holster, or 80 Series meters in C81 Holster. Water resistant zipper, two inside pockets.

C90 Soft Case (not shown). Similar to C25, but smaller and without accessory storage space or water resistant zipper. One internal pocket; will hold Fluke 21, 23, 50 or 70 Series meters in a C70 holster. Not for Fluke 25, 27 or 80 Series.

C40 Soft Case



For Fluke 45. Test lead storage in removable upper pouch, shoulder strap.

Y8205 Soft Case (not shown). Similar to C40, for other bench DMMs, counters, thermometers. Test lead storage in removable upper pouch.

C50 Compact Soft Case



Vinyl case with belt loop. For Fluke 21, 23, 50 and 70 Series without holster. Holds meter, manual, and leads.

C70 Multipurpose Holster



For Fluke 21, 23, 50 and 70 Series (included with Fluke 23 and 77). Lead storage on back; includes tilt stand and belt hook.

C75 Test Lead Case



Vinyl carrying case with two inside pockets. Designed to carry test leads, test probes or clips (except AC83). Will not accommodate large accessories. Size: 7.25" x 4.25" x 1.25" (190.5 mm x 108 mm x 31.8 mm).

C81Y/C81G Holster



For 80 Series DMMs. Yellow version (C81Y) is included with multimeter. Grey version (C81G) is optional. Lead and probe storage on back; includes flexible tilt stand.

C100 Universal Carrying Case



For any Fluke handheld DMM or Fluke 50 Series thermometers and most Fluke DMM accessories. Tough polypropylene case provides protection against rough handling and bad weather.

C86 Ruggedized Case (not shown) Similar to C100, for Fluke bench DMMs (except Fluke 37 and 45). Will hold standard test leads.

80T-150U Universal Temperature Probe

High accuracy P-N junction probe converts any DMM into a thermometer. Switch selectable for °F or °C. Features 350V dc or peak ac isolation.

Suitable for air, surface and non-corrosive liquid measurement applications. Basic accuracy: $\pm 1^{\circ}\text{C}$ (1.8°F), 0°C to 100°C . Range: -50°C to $+150^{\circ}\text{C}$ (-58°F to $+320^{\circ}\text{F}$).

80TK Thermocouple Module

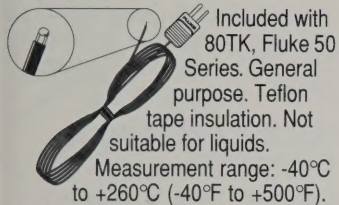
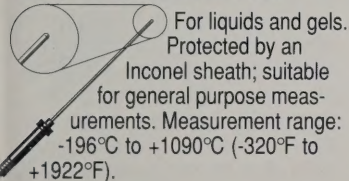
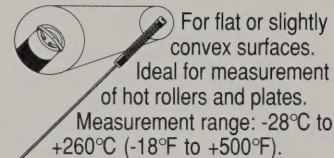
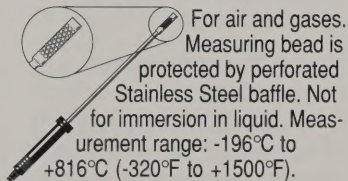
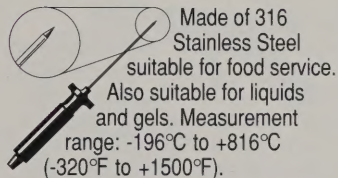
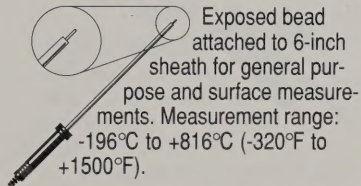
Converts any 10 M Ω DMM into a thermometer via standard banana plugs. Uses K-type thermocouple with mini-connectors. Switch selectable for °C or °F. Use with interchangeable probes described on next page (one 80PK-1 Bead Probe included). Basic accuracy: $0.5\% \pm 2^{\circ}\text{C}$ ($0.5\% \pm 3.6^{\circ}\text{F}$).

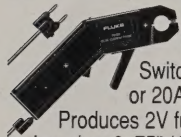
80CK-M Male Mini-Connector

Package of two male mini-connectors for use with Fluke 80TK or Fluke 50 Series. Isothermal screw terminals for attachment of K-type thermocouple wire.

80CJ-M Male Mini-Connector

Same as 80CK-M, for J-type thermocouple wire. For use with Fluke 50 Series.

80PK-1 Bead Probe**80PK-2A Immersion Probe****80PK-3A Surface Probe****80PK-4A Air Probe****80PK-5A Piercing Probe****80PK-6A Exposed Probe**

Y8100 Clamp-On AC/DC Current Probe

Battery powered.
Switch selectable 200
or 20A current range.

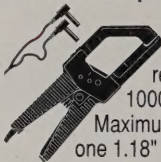
Produces 2V full range output.

Jaw size: 0.75" (1.9 cm). Accuracy:
 $\pm 2\%$ of range from dc to 200 Hz.

Y8101 Clamp-On AC Current Probe

Measures ac current
from 1A to 150A. Divi-
sion ratio is 1000:1. Jaw

size: .43" (1.1 cm). Accuracy:
 $\pm (2.5\% + 0.15A)$ 48 Hz to 440 Hz,
 $\pm (3\% + 0.15A)$ 440 Hz to 1200 Hz.

80i-400 Clamp-On AC Current Probe

Measures ac cur-
rent from 1A to 400A.
1000 to 1 division ratio.

Maximum conductor size:
one 1.18" (30 mm) or two
0.98" (25 mm). Accuracy:

$\pm (3\% + 0.4A)$ 48 Hz to 440 Hz,
 $\pm (4\% + 0.4A)$ 440 Hz to 1000 Hz.

80i-410 Clamp-On AC/DC Current Probe

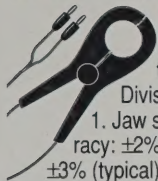
(not shown) Similar in appearance to
80i-400. Battery-powered Hall-effect
clamp-on probe measures ac or dc
current from 5A to 400A. Maximum

conductor size: one 1.18" (30 mm) or
two 0.98" (25 mm). Output is 1 mV per
amp dc or ac. Accuracy: $\pm (5\% + 2.5A)$,
5A to 400A, dc to 62 Hz. Useable to
400 Hz.

80i-1010 Clamp-On AC/DC Current Probe

(not shown) Similar in appearance to
80i-400. Battery-powered Hall-effect
clamp-on probe measures ac current
to 700A, dc current to 1000A. Thumb-
wheel ZERO control compensates for
residual core magnetism, improving
the accuracy of dc measurements
down to 1A. Output is 1 mV per amp
dc or ac. Accuracy: $\pm (2\% + 1A)$, 1A to
100A, dc to 62 Hz. Useable to 440 Hz.

80i-600 Clamp-On AC Current Probe



Measures ac current from 1A to 600A.

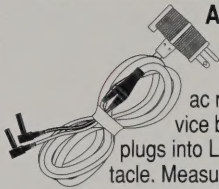
Division ratio is 1000 to 1. Jaw size: 2" (5 cm). Accuracy: $\pm 2\%$, 50 Hz to 1 kHz, $\pm 3\%$ (typical) 30 Hz to 10 kHz.

80J-10 Current Shunt



Allows measurement of ac or dc current with precision DMM (such as an 8050A or 8060A). Will pass 10A continuously, 20A for one minute. Accuracy: $\pm 0.25\%$ from dc to 10 kHz.

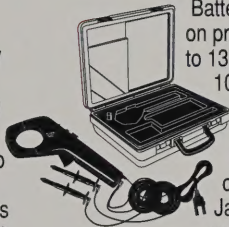
LCA-10 Line Current Test Adapter



Connects directly to 120V ac receptacle; device being measured plugs into LCA-10 receptacle. Measures ac current to 10A, (20A for 30 seconds).

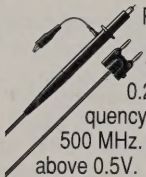
Shrouded input plugs complete series connection through meter's 10A input, producing most accurate measurement. For use in United States, Canada, Japan, Mexico, Taiwan and other countries using U.S. style plug.

80i-kW Current/Power Probe



Battery powered clamp-on probe measures 1A to 1300A dc, 1A to 1000A ac (48 Hz to 440 Hz), 0.5 kW to 330 kW (48 Hz to 63 Hz). Includes case and manual.

Jaw size: 2.38" (60 mm). Accuracy: $\pm 2\%$ + 2A) for current, $\pm (3.5\% + .5kW)$ for power.

85RF High Frequency Probe

Provides dc output for high frequency ac voltage inputs from 0.25V to 30V rms. Frequency range: 100 kHz to 500 MHz. Accuracy: ± 0.5 dB above 0.5V.

83RF (not shown) Similar to 85RF, with frequency range from 100 kHz to 100 MHz. Accuracy: ± 1 dB above 1V.

80K-40 High Voltage Probe

40 kV dc or 28 kV rms ac. 1000 M Ω input impedance. Dc accuracy: $\pm 1\%$, 20 kV to 30 kV, changes linearly from 1% at 30 kV to 2% at 40 kV, and from 1% at 20 kV to 2% at 1kV. Ac accuracy: $\pm 2.5\%$ at 60 Hz.

80K-6 High Voltage Probe

6000V dc or peak ac. Accuracy: $\pm 1\%$, dc to 500 Hz, $\pm 2\%$, 500 Hz to 1 kHz.

WARNING--To avoid damage or electric shock, use high voltage probes under dry conditions in low energy applications, such as CRT supplies.

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